APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER | Air Circuits · Electrical Controls

FRANCHISE CIRCULATION

MARCH 1957

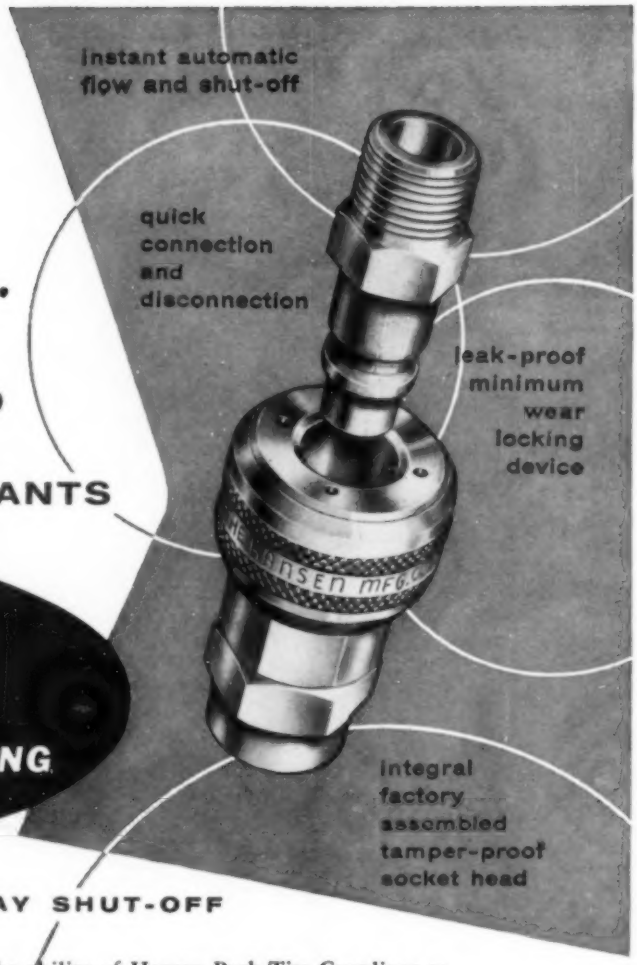
HOW TO DESIGN
MAGNETIC PLUG ASSEMBLIES
IN HYDRAULIC RESERVOIRS | PAGE 73

For Information About
1957 PRIZE PAPER CONTEST
See page 156

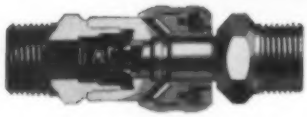
AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

Thoroughly Proved...

BY YEARS OF HARD EVERYDAY USE IN THOUSANDS OF PLANTS


instant automatic flow and shut-off
quick connection and disconnection
leak-proof minimum wear locking device
integral factory assembled tamper-proof socket head

HANSEN
QUICK-CONNECTIVE
PUSH-TITE COUPLING



Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with plug, thereby preventing wear and subsequent leakage.

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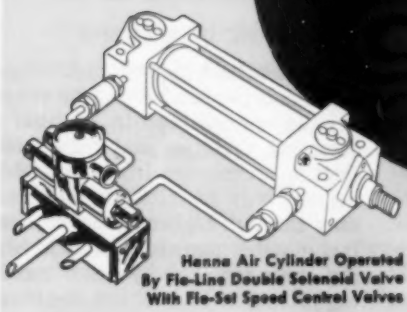
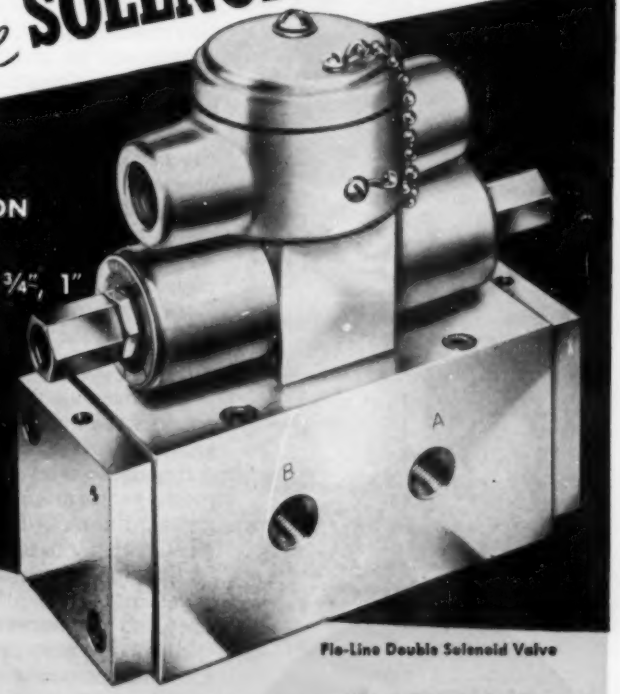


Hanna Air Cylinder Operated By Flo-Line Double Solenoid Valve With Flo-Set Speed Control Valves



Flo-Line Double Solenoid Valve

Hanna has designed and built new and unusual features in their Flo-Line Solenoid Valves . . . features that result in economy, more versatile operation and safety. Here are some of them:

- **Bubble Tight Spool** positively sealed by "O" rings.
- **Dust-Tight, Splash-Proof Design** to seal out dirt and moisture, and assure trouble free performance.
- **Few Moving Parts** for longer valve life.
- **Full Pipe Capacity** for all internal passages.
- **Wide Range of Temperatures and Pressures** —40° F. to 125° F.; 20 to 150 psi air. Options permit air pressure to 250 psi and even vacuum!
- **Enclosed Solenoid Coils** for safe operation.
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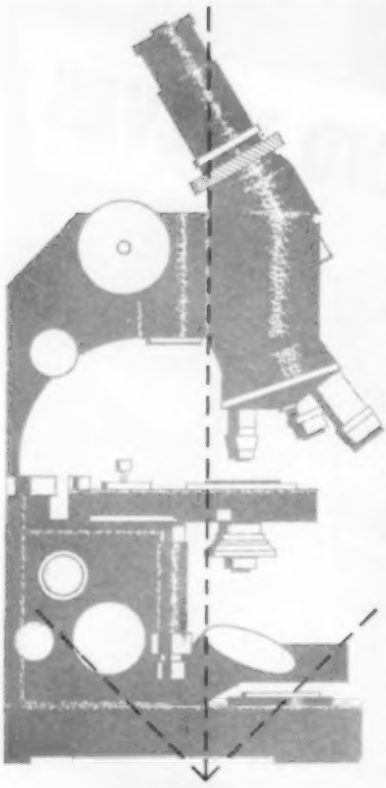
- **Meets JIC Recommendations** in all respects when ordered with optional manual over-ride.
- **Side or Manifold Porting** for easy installation and convenient piping.
- **Choice of Spools** permits selection of a standard valve for most applications.
- **Manual Over-ride,** an optional feature, allows equipment to be tested before final electrical installations are made and provides a means of operating the valve in case of electrical failure.
- **Junction Box** for ease in making electrical connections.
- **Modern Clean Cut Appearance**

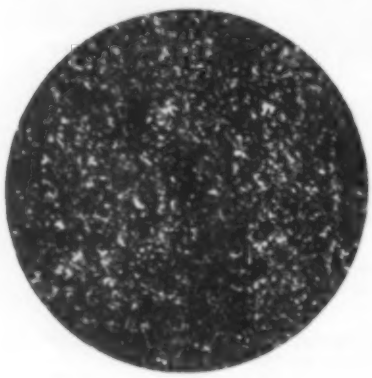
You'll surely want the complete details given in the new Hanna Flo-Line Catalog No. 261A. See your classified telephone directory or Thomas' Register for the name of your nearest Hanna Representative—or write us direct.

Hanna Engineering Works

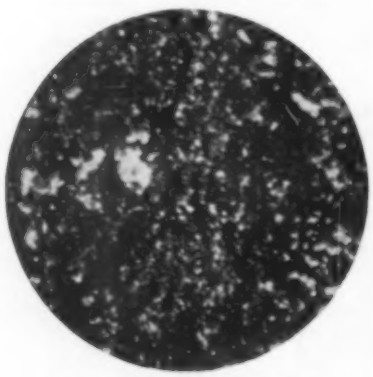
HYDRAULIC AND PNEUMATIC EQUIPMENT • CYLINDERS AND VALVES
1741 N. Elston Ave., Chicago 22, Illinois

how injection molding can help you solve design problems and improve products that require rubber parts . . .





Modern injection molded rubber.



Standard compression molding.

Greater density produced by injection molding of rubber is shown in comparison to ordinary compression molding. Injection molded rubber (top) displays homogeneous characteristics unequalled for consistency or toughness by any other process. In application, this will mean tremendous resistance to abrasion and chemical action—much longer life for rubber parts. Both microphotographs are standard Buna N compound, approx. .269″ x .019″, magnified 240 diameters by the University of Minnesota.

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THE MAGAZINE OF FLUID POWER

MARCH 1957 • VOLUME 10, NO. 3

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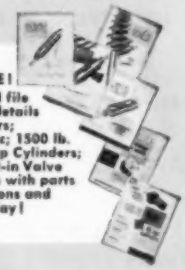

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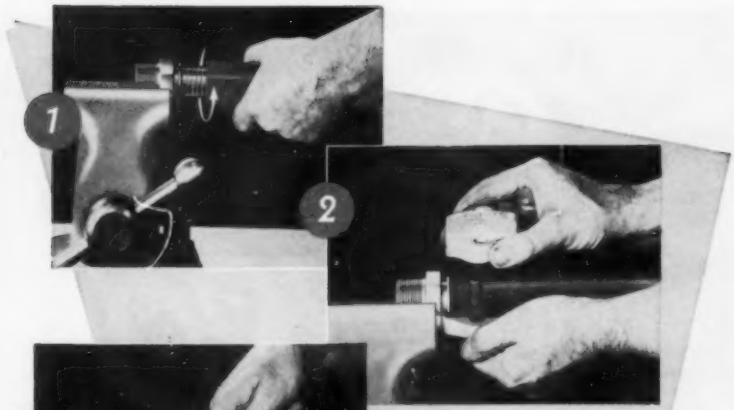

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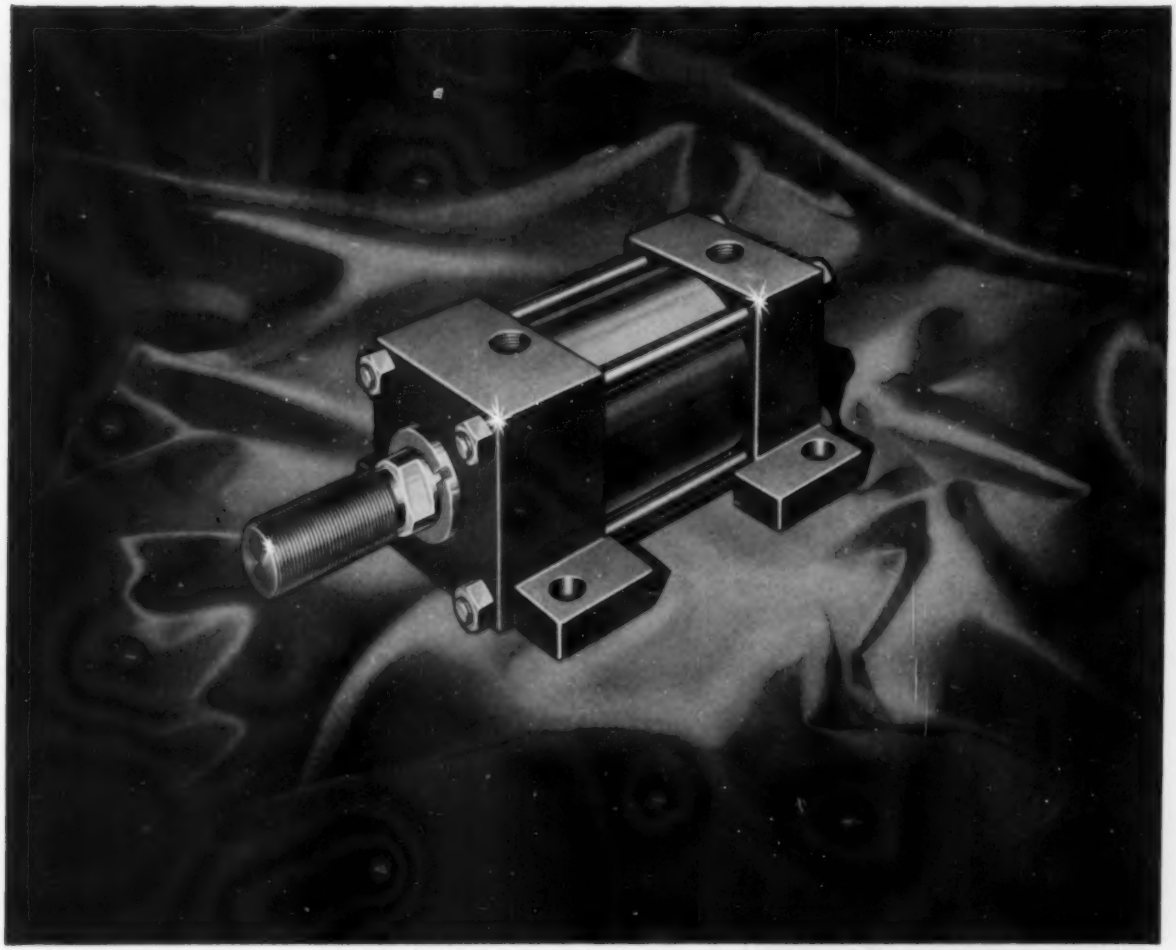

Illustrated—Logan Super-Matic Cylinder Meets J.I.C. Standards

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Fluid Power Lines

about Applied Hydraulics

THREE OR FOUR HOLERS . . . Russ Hemeon who authors this month's lead article is a great one for applying provocative everyday terms to engineering techniques and products. If you've been fortunate enough to hear one of his rapid-fire slide lectures, you're familiar with decapitated relief valves, c. p. fluid (that's very low-grade fluid), etc. His discussion of magnetic plug assemblies this month was not without a Hemeonism. We somewhat reluctantly edited out and used the term *magnetic plug assembly* in place of *two-holers, three-holers,* etc. Not that we are prudes, mind you, but here's a case where talkin' and writin' can't quite be the same. Anyway, now that we have sneaked in the terminology, you can apply it when you get over to page 73.

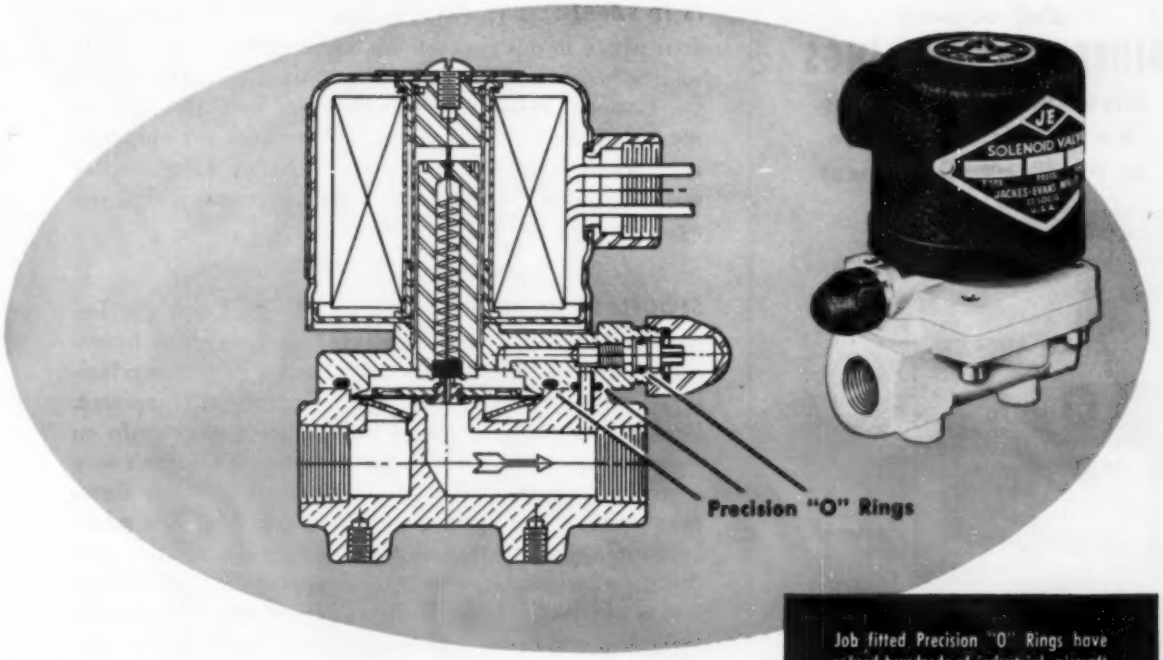
CIRCUIT IDEAS . . . We, of course, like everything in AH from cover to cover. But quite frankly, we're very partial to articles which show how to get an air or oil circuit to behave. John Fawcett's article this month is the kind that really makes you do some analyzing. Presents a bit of a challenge.

BETTER TESTS, LESS TROUBLE . . . During a tour through Plymouth's new engine plant which turns out V-8's in Detroit, we talked with A. J. Phillips and several other men responsible for hydraulic repair on the many oil-powered production machines in this plant. We were shown the test equipment described in the article appearing on pages 98 and 100. Its use reduces expensive machine downtime. If you are looking for practical maintenance ideas, this is it.

NOTHING LIKE THE 440 . . . We haven't been so enthusiastic about relays since our college track days, working up this month's electrical component article on relays and contactors. We pooled our experience with manufacturers' and application engineers' know-how to bring you a "survey" piece on these common electrical items. Understanding the construction features, specifications, and maintenance of relays is part of the training of a fluid power engineer who knows his electrical control. A follow-up article on relays, next month, will show circuits for fluid power control.

PNEUMATICS AND PACKAGING . . . Two articles describing the use of pneumatics for packaging show two extremes in this industry. One article tells how air is used in the design of automatic equipment to bottle cosmetics. The second shows how large washing machines are packaged for shipping. Both jobs use 80-psi air and very similar circuitry yet the end products are very different animals.

SPECIAL PRECISION "O" RING meets low temperature flexibility requirements



Resiliency maintained at 1 P.S.I.

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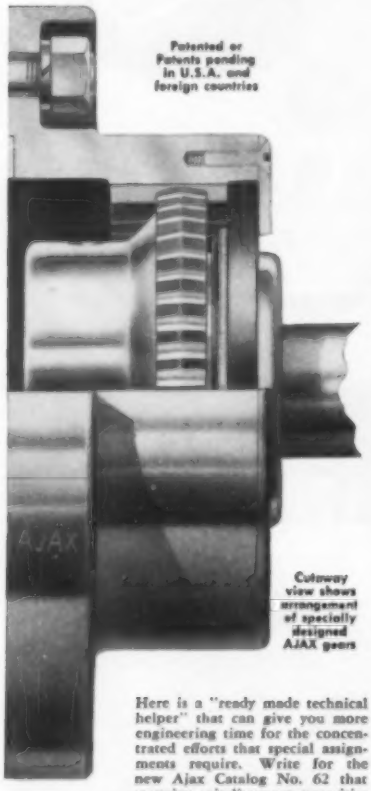

Cutaway view shows arrangement of specially designed AJAX gears

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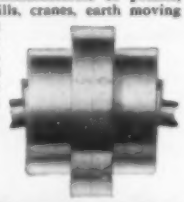

Write today for your personal copy of Bulletin No. 62.

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Fluid Power Lines

continued

IS IT SAFE? . . . There's a couple of fellows in the next-door office to our's who think about safety most of their waking hours, and incidentally put out a magazine called Occupational Hazards. Most designers keep this item at the top of their check list too, and methods for electrical interlocking have become standard. Safety measures for manual controls, however, can demand some design imagination like that shown on page 76.

SEQUEL TO DECEMBER . . . You'll recall that the December AH covered the design and application of hydrostatic transmissions on industrial trucks, mining, agricultural, railroad maintenance, and construction equipment. Back in our planning stages we also tried to get info on possibilities of this transmission on autos. We weren't very successful talking to Detroit people, so we put our European editor, John Lankester, on the job. The idea might be more appealing to Europeans who make smaller cars and are efficiency conscious. John approached Ian McNeil who is a hydraulic consultant—also the author of *Hydraulic Operation and Control of Machines,* an excellent text. Mr. McNeil, who must be fearless, has written an article for this issue. The article won't even create a ripple in "horsepower berserk" Detroit, but industrial equipment engineers will find some good ideas in it.

HYDRAULIC ELEVATOR . . . Use of hydraulics to power a multi-story elevator has a long and somewhat erratic history. However, things are looking up—forgive us we couldn't resist the pun. New York's new Colesium has a fine four-story installation. It's described in an article this month.

WHAT'S A MICRON? . . . There's lots of talk about microns in the aircraft article about filter evaluation-this unit of measure is 39 millionths of an inch. To any machine designer that's a ridiculous tolerance, but for high performance hydraulic systems, precision valves demand such filtration fineness. How to tell just how good a filter *is* is a problem for both users and manufacturers. George Keller, author of the new book, *Aircraft Hydraulic Design,* describes three evaluations tests and makes suggestions for possible improvements. AH is now surveying filter manufacturers on this subject, and a future article will present their thoughts on filter evaluation. If you have any comments, write us.

Now 2 HOUGHTO-SAFE Hydraulic Fluids

to give you

Two Fire-Safe Hydraulic Fluids to provide maximum operating efficiency and eliminate danger of Hydraulic Fires

Up to eighty-five percent of all hydraulic applications can operate at top efficiency . . . with complete protection from fire danger . . . with Houghton's Houghto-Safe 620. Houghto-Safe 620 is a water-base fluid which will not burn nor explode. Packings don't have to be changed when you install it. It is non-toxic, safe to handle. It guards against rust and corrosion. Plus benefit: Houghto-Safe 620 costs less than other types of fire-resistant hydraulic fluids.

For systems running consistently above 150°F. and for heavily loaded pumps and bearings, you can get peak hydraulic efficiency with Houghto-Safe 1020. This is a new, specially compounded and fortified synthetic fluid—a further exclusive development of Houghton Research that serves to prevent rust, resist foaming and increase the oiliness factor, thus reducing wear.

Ask your Houghton Man about the two types of Houghto-Safe. He'll be glad to show you how they can take fire danger out of *any* hydraulic job in your plant. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

HOUGHTO-SAFE . . .
a product of

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PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO

Ready to give you on-the-job service . . .

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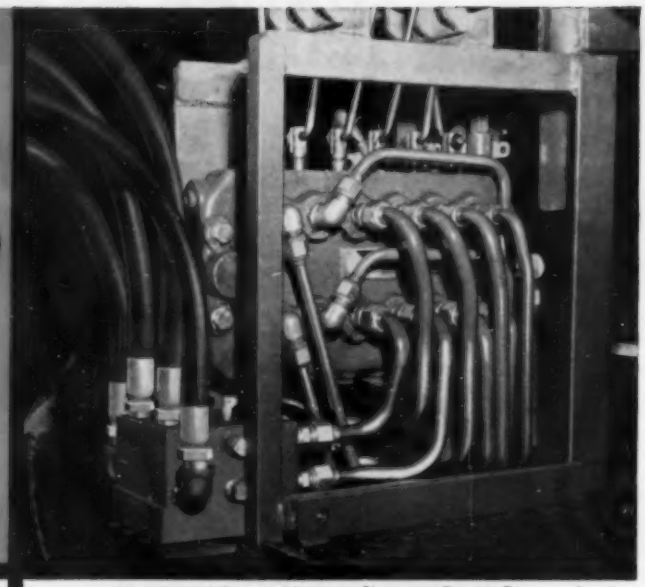
FULL PAYLOAD POWER



Close-up of Power Unit on Sherman Power Digger showing direct power delivery from *lever to load*. Pilot model equipped with Eastman Hydraulic Hose and Tube Assemblies.

International Harvester Model 75 Payscraper. First application of hydraulic steering on earth movers. USER OF EASTMAN EQUIPMENT.

Allis-Chalmers Model 100 ALL CROP Harvester. Steering brakes and header height hydraulically operated. USER OF EASTMAN EQUIPMENT.

Bucyrus-Erie Model H-5 Hydrocrane. Hydraulically controlled boom, out riggers and bucket. USER OF EASTMAN EQUIPMENT.

FOR FULL PAYLOAD POWER FROM LEVER TO LOAD specify

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HYDRAULIC HOSE ASSEMBLIES

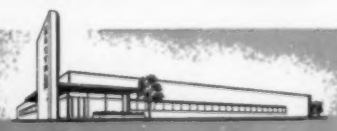
For full payload power—*from lever to load*—consistent with long-lasting service, safety and sound construction—always specify Eastman Hydraulic Hose Assemblies.

Eastman, *first in the field* of Hydraulic Hose Assemblies, developed many original engineering advantages in design, construction and assembly—time tested by *unequalled* years of experience.

Since Eastman pioneered in the very first applications of mobile hydraulic power . . . you will find Eastman Hydraulic Hose Assemblies used by many original equipment manufacturers who were pioneers in their respective fields also.

Let *their endorsement be your assurance* of the satisfactory hydraulic performance of your products, too—plus the prestige and competitive sales advantage that comes with quality Eastman Hydraulic Hose and Tube Assemblies—*the Standard of the Industry!*

It pays to write Eastman ***FIRST***... *because Eastman was first in the field of Hydraulic Hose Assemblies*



Eastman *first in the field*

MANUFACTURING COMPANY, Dept. AH-3, MANITOWOC, WIS.

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Fluid Drive

How can I obtain more information about "Fluid Motor in Drive Wheels" covered in the December issue of APPLIED HYDRAULICS?

RICHARD B. ROSSEAU
Resident Engineer
Chain Belt Company
Los Angeles, Calif.

The article referred to contains most of the available information on this project. However, if you have any specific questions, you might wish to correspond with the author, H. J. Hamblin, Head Mechanical Engineering Development, The Institution of British Agricultural Engineers of London, England.

4-Way Valves

I would like to control two double acting cylinders, at right angles to each other, from one manual valve control knob. Can you give us a supply source?

R. W. CARY
Engineering Dept.
Lane Manufacturing Co.
Montpelier, Vt.

There are a variety of 4-way valves which could control these two double-acting cylinders. The valve handle would have a forward and return position, which could be identified very easily. Your copy of the January "Designers' Guide Issue" will give you complete information concerning suppliers of directional control valves.

Damping Device

We require a small hydraulic device for damping the shock due to the bottoming of a fairly fast moving hydraulic cylinder. We cannot obtain this cushioning

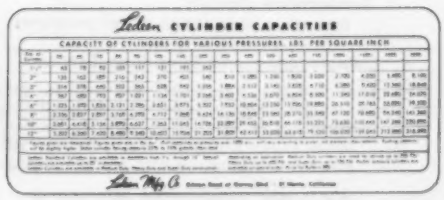
Continued on next page

NEED A CYLINDER?

Ledeen Stocks Them or Builds Them to Fit Almost Any Application

For normal applications requiring standard cylinders or for those unusual applications where a special cylinder is needed, see Ledeen.

Let us know the type of job to be done and how much cylinder power you need. Send for this handy cylinder capacity chart.



Write for Bulletin 500

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND TEST STANDS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California

Custom Engineered to Your Specifications!*

MARSH IMPREGNATED THERMO LEATHER PACKINGS

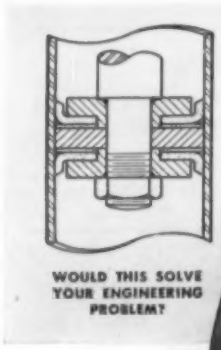
Where your need is quality controlled leather packing

• to serve a specific static or running application • to fit a special temperature range • to meet specific pressure requirements

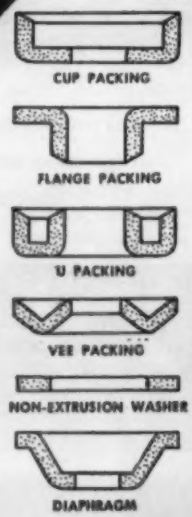
Marsh Impregnated Thermo Leather Packings are Custom Engineered!

Where you specify leather packing for operating pressures, for pressure mediums, MARSH provides superior custom packing!

* Forming Cutting Treating



WOULD THIS SOLVE YOUR ENGINEERING PROBLEM?



- **Low coefficient of friction** both static and running
- **Greater wear resistance** combines toughness with strength
- **Tighter sealing** proper impregnation for varied pressures
- **Temperature stability** through a wide range of temperatures

Engineering and Consulting Service

If you seal oil, water, air, vacuum, gas, gasoline, naphtha, alcohol or other fluids, ask MARSH for field engineering service, immediately available to you for the job you are designing, tooling, manufacturing.

WRITE FOR ENGINEERING HANDBOOK AND TECHNICAL LITERATURE . . .

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Sales Offices 75 E. Wacker Drive, Chicago 1, Illinois | 1900 Euclid Avenue, Cleveland 15, Ohio | 101 Park Avenue, New York 17, New York

LETTERS to the editor

effect inside of the cylinder because of its extremely small bore.

We would like a small, self-contained, adjustable device—perhaps a double-acting, equal area piston that cycles its own oil supply through an adjustable needle valve with a spring return to center the device for the next stroke.

SOL DUDNICK
Design Engineer
Universal Machine Co., Inc.
Baltimore, Md.

If space permits, you may be able to use external deceleration valves. While you may have to design your own unit, have you considered commercially available surge conrtol valves or dashpot cylinders?

Do any of our readers have a solution to this problem?

Smooth Motion

Please send us two copies of the October 1956 issue. David Hutchinson's circuit design article, "No Jump Circuit to Smooth Motion of Machine Table," is of particular interest to us.

ROBERT R. SPALHOLZ
Project Engineer
The Farmingdale Corporation
Farmingdale, N. Y.

Tearsheets of this article have been sent.

Fluid Control Institute

In your January 1957 issue you mention a spring meeting of the Fluid Control Institute at Greenbrier Hotel, White Sulphur Springs, W. Va., on May 8-11. Could you give us further details on this?

A. T. DEWEES
Sales Promotion Manager
Hose Accessories Co.
Philadelphia, Pa.

This organization was formerly known as the National Steam Specialty Club. The Institute consists of manufacturers of automatic regulating valves, control valves, solenoid valves, space heat-

Continued on page 18

0-175 GPM

SANDERS Electro-hydraulic

SERVO VALVES

0-5 GPM

Industry's smallest valve.
Dim.: 1.1" x 1.1" x 3.9"

...One of them may solve your problem

Among the most important operational advantages built into Sanders servo valves is adaptability. The standard models shown here are being used successfully in industrial, marine, and aeronautical applications of an ever-increasing variety. Their flow capacities range from 5 to 175 GPM at 1000 psi. across the valve, and 3000 psi. supply pressure. Valves with higher flow capacity can be produced to specification.

In fact, where conditions demand, Sanders offers a complete engineering service for designing special valves and hydraulic systems.

In addition to servo-valve diversification, Sanders' proven production ability is backed by extensive manufacturing facilities, precision equipment and skilled personnel.

Sanders electro-hydraulic servo valves feature . . .

- **Low resolution**
- **Compactness**
- **Wide frequency response**
- **Self-cleaning action**
- **Low input power**
- **Excellent linearity**
- **External adjustments**
- **Extended temperature range**

Want the detailed story? Write today for complete information. If you prefer, ask to have a Sanders Application Engineer call for consultation. No obligation, of course.

SANDERS ASSOCIATES INCORPORATED Dept. AH-3 NASHUA, NEW HAMPSHIRE

West Coast Field Office: 7335 VAN NUYS BLVD., VAN NUYS, CALIFORNIA, Tel. STATE 0-2720

Circle 139 on Reader Service Card

GARLOCK and *Announce*

THE COMPLETE INTEGRATION OF THEIR SALES FORCES

Now, the United States Gasket Company will be known as the United States Gasket Company, Plastics Division of The Garlock Packing Company.

In August 1955 Garlock acquired the United States Gasket Company. Subsequently, the production facilities of both companies were integrated. Now, it is clear that the customers of both companies will be better served through an integrated sales force.

Better Service for Customers

Both U.S.G. and Garlock customers will now enjoy the finest, most complete service available in the fields of fluorocarbons (Teflon* and Kel-F**), nylon and other plastics as well as mechanical packings and seals of all types. Specialists in specific materials and applications will always be available for consultation on your problems.

Saves You Time

This integration of sales forces will also simplify your purchasing problem . . . you can standardize on one reliable source of supply and have more time to devote to other important problems.

Unbiased Recommendations

With the addition of U.S.G. plastic products to the famous "Garlock 2,000" family of packings, gaskets, and seals, your local representative is able to supply the right seal for every conceivable need. Call him at the office nearest you.

30 Sales Offices

U.S.G. plastics specialists join the 125 Garlock salesmen at 30 sales offices and warehouses where large stocks of plastic products are stored. This means faster deliveries from local stocks, as well as expert plastics and sealing assistance as close as your telephone.

*DuPont Trademark
**M.W. Kellogg Trademark

Main Factory Buildings of The Garlock Packing Company, Palmyra, New York. Other factories in San Francisco and Canada.

One of the two Camden, N.J. plants of the United States Gasket Company, Plastics Division of The Garlock Packing Company

United States Gasket

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Birmingham 1, Ala., *519 S. 19th St.*
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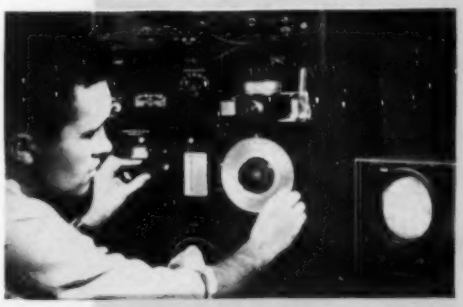
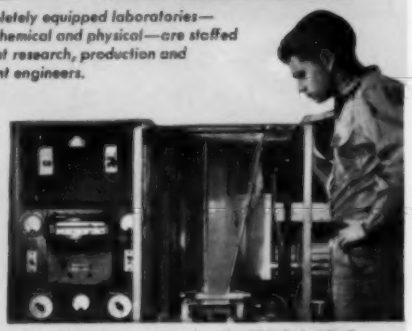
SPECIALIZED PLASTICS PRODUCTS FACILITIES AT U.S.G.



Three completely equipped laboratories—electrical, chemical and physical—are staffed by top-flight research, production and development engineers.



One of many extruders for TEFLON, KEL-F and nylon rods, tubes and special shapes.

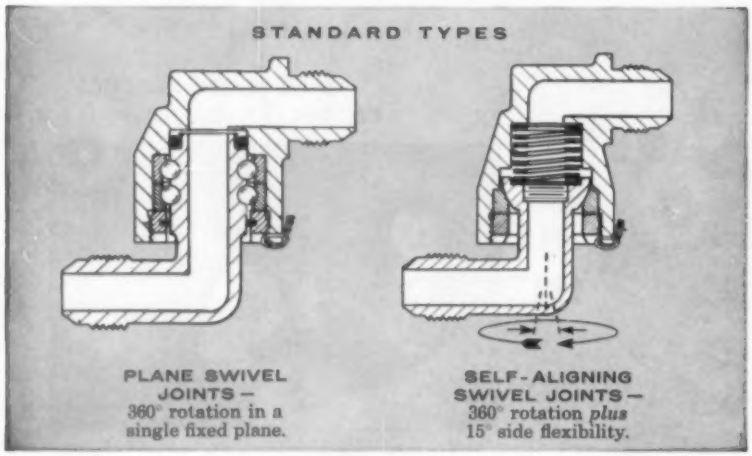
Giant presses cold mold TEFLON sheets up to 48" x 48" in size, ready for sintering.

High product, low-cost injection molding of thermoplastic parts to manufacturers specifications.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products

ONLY *BARCO* OFFERS TWO STANDARD TYPES!


STANDARD TYPES
PLANE SWIVEL JOINTS — 360° rotation in a single fixed plane.
SELF-ALIGNING SWIVEL JOINTS — 360° rotation *plus* 15° side flexibility.

— plus special designs for individual requirements . . .

LOW PRESSURE JOINT FOR AIRSPEED INDICATOR

LANDING GEAR HYDRAULIC ASSEMBLY

MISSILE LAUNCHER HYDRAULIC ASSEMBLY

WING FOLD AND IN-FLIGHT FUELING JOINT

Since 1941, BARCO Swivel Joints have been approved for in-flight service. Today, you'll find Barco Flexible Joints and Assemblies on latest Supersonic and Military Equipment.

SEND FOR NEW CATALOG 269-A — gives details on Barco swivel joints and their application to many types of flexible assemblies. Also shows leakproof method of joining assembly components.

BARCO *Serving Industry Since 1908* AIRCRAFT DIVISION
MANUFACTURING CO., 532-D N. Hough St., Barrington, Ill.

LETTERS to the editor

ing specialties, steam gage traps and steam heating pumps.

You can get more information by writing to R. McCormick, Publicity Release Committee, who is located at Automatic Switch Company, 50-B Hanover Rd., Florham Park, N.J.

Source For Components

Having recently become deeply involved with hydraulic circuits, we wonder if there is some source of information, specifically for hydraulic components?

R. J. LINDBERG
Research Engineer
Hewitt-Robins, Inc.
Passaic, N. J.

We have sent a copy of the January "Designers' Guide Issue", which will certainly solve many of your supply problems.

You will find APPLIED HYDRAULICS *your best source for information concerning air and hydraulic circuits. We also recommend the* MASTER CATALOG OF FLUID POWER PRODUCTS *which can be ordered from us. Price is* $6.50 *a copy.*

Designers' Guide Issue

I am sending my 50 cents so you can measure the value of your magazine as per your request on page 8 of the January issue. When you are finished measuring the value kindly send the writer a copy of the Air & Oil Circuit Guide.

I enjoy reading your magazine when I can scrounge it from the boss.

H. M. VAUGHAN
Richmond, Virginia

Your request and those of some 384 companies and individuals to date are indeed gratifying. A great amount of work and money went into the preparation of the Designer's Guide Issue. Not many extra copies of the issue will be left by the time this column is in print. Orders for the Air and Oil Circuit Guide total more than 3000 copies

Continued on page 20

What's this?

. . . a hydraulic pump unit. But there's more to it than meets the eye.

The PRESSURE it develops is infinitely ADJUSTABLE, yet NO RELIEF VALVE is used, and thus no power is wasted.

If desired, the VOLUME of oil delivered can also be infinitely ADJUSTED . . . or reversed . . . WITHOUT using a FLOW CONTROL VALVE.

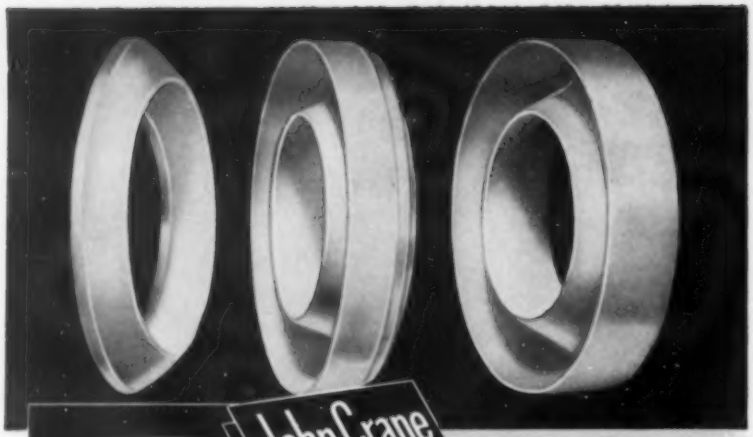
NO OIL COOLER is normally required, even though this unit can run CONTINUOUSLY at 3000 p.s.i.

All the types of CONTROLS for this pump are out where they can be seen . . . not hidden inside. They are SIMPLE both in basic design and operation.

And the variety of controls . . . well, why not write for the details as applicable to your particular requirements!

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.



John Crane

CHEMLON *

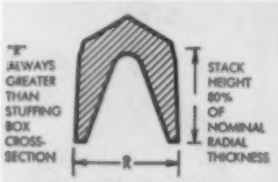
C-V RINGS

ARE INDUSTRY'S MOST UNIVERSAL PACKING . . .

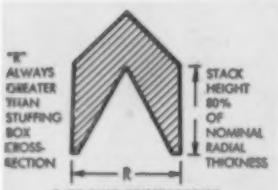
Countless successful applications of C-V Rings under the most severe service conditions have made this the closest approach to a universal packing.

It will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from −120°F. to +500°F. . . . is equally suited to valves, pumps, mixers, hydraulic cylinders and like equipment.

"John Crane" C-V Rings have extremely low coefficient of friction. "Breakout" friction is only slightly higher than running friction.



C-VU RING CONSTRUCTION



C-VH RING CONSTRUCTION

TWO STYLES ARE AVAILABLE:

C-VU RINGS *for low pressure service* —such as control and regulator valves handling gases and fluids, where it is necessary to have a very sensitive and resilient type packing.

C-VH RINGS *for high pressure service* —for use in pumps, hydraulic cylinders and like services at pressures ranging to 500 psi. and over. These rings are constructed with a heavy wall heel to withstand pressure requirements. They are designed to provide voids between rings, so that as the Teflon expands due to heat, this take-up room minimizes any excess friction in the stuffing box.

"John Crane" C-V Rings are available in full line of standard sizes and male and female adaptors. Sizes can be molded to stuffing box specifications.

Request Bulletin P-325

*"John Crane" C-V Rings are made from Chemlon—*the best in DuPont Teflon.*

Crane Packing Co., 6405 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

CRANE PACKING COMPANY

LETTERS to the editor

so far. Here are just a few samples of the requests.

Please forward an additional copy of the January edition of APPLIED HYDRAULICS. This data will be useful to our Engineering Dept. and we intend to keep this copy intact in our engineering file. I will gladly remit cost.

C. C. SOPER
Chief Engineer
Ferry Machine Company
Kent, Ohio

We just received your January product selection issue. We would appreciate your sending us three copies as we feel it is a terrific copy.

KONG GO
Job Engineer
Kaiser Engineers
Oakland, Calif.

Check enclosed for five copies.

Portsmouth Naval Shipyard

I have noted with interest the compilation of components and sources in your January 1957 issue. Please send three more copies. Check is enclosed.

FRANK GAARDE
Project Engineer
American Machine & Foundry Co.
Greenwich, Conn.

Check enclosed for eight copies of the January issue.

FRANK S. HAVEL
Design Engineer
Reynolds Metals Co.
Brookfield, Ill.

Please send us 200 extra copies of the complete issue.

Vickers Inc.
Detroit, Mich.

Please send and bill me for either a reprint of "Air and Oil Circuit Guide" as published in the January 1957 issue, or a copy of the issue itself.

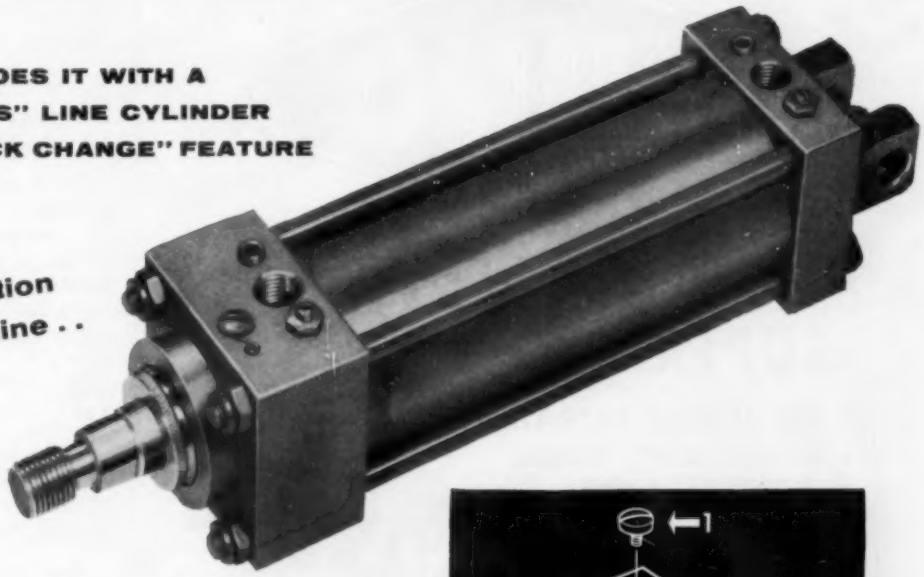
JOHN PEARSON
Senior Engineer
Food Machinery and Chemical Corp.
Pocatello, Idaho

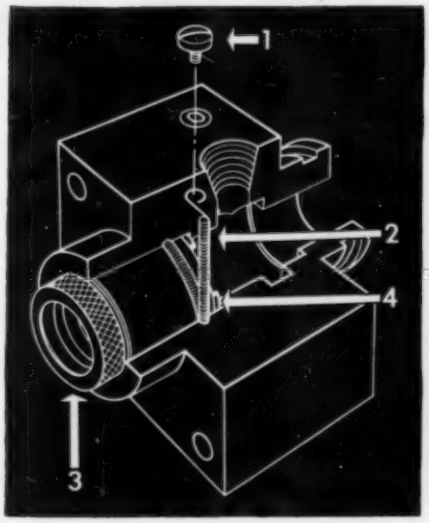
Continued on page 22

Minute Maintenance
CUTS COSTLY DOWNTIME . . .

EASY DOES IT WITH A LINDBERG "S" LINE CYLINDER WITH THE "QUICK CHANGE" FEATURE

Newest addition to a proven line . .

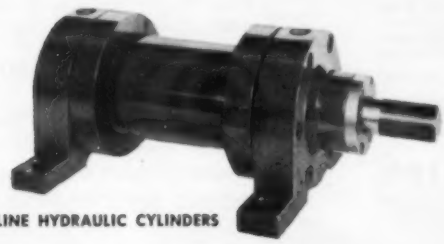




That's right, with a Lindberg "S" Line cylinder you can replace, if necessary, "U" cup Rod Packing, "U" cup Wiper, Cartridge Seal or the entire Rod Cartridge Assembly *in minutes*, without special tools or equipment.

HERE'S HOW: Remove Retaining Screw (1) (see cutaway, right) • Strip out Rod Cartridge Retaining Spring (2) • Twist Rod Cartridge (3) to free from Rod Cartridge Seal (4) and withdraw from Rod End Head • Reverse procedure to assemble and you're back in business—without a long, costly delay.

"S" Line cylinders last longer too. Chrome plated steel tube honed mirror bright • Chrome plated manganese steel Piston Rod • Tie Rods—pre-stressed to carry equal load • Full floating cushions • 23 other soundly engineered features mean extra life and lower per hour cylinder costs for you. 7 bore sizes to 6" —Rated 250 psi pneumatic, up to 1000 psi hydraulic—Mounting styles to fit your needs—Standardized mounting dimensions—Built to JIC recommendations. Send today for your copy of Bulletin S-101 on Lindberg Squarehead "S" Line Cylinders.



"H" LINE HYDRAULIC CYLINDERS

OTHER VERSATILE LINDBERG CYLINDERS

2000 PSI "H" LINE—Hydraulic—Shown left, bore sizes up to 8", with or without cushions, standard or 2:1 rods, mounting styles to fit your needs • "A" LINE—Air or Hydraulic—A rugged, non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service • MILL TYPE AND OTHER SPECIALS—For information, send outline of your requirements.

Write for free literature and the name of our representative near you.

TEER-WICKWIRE & CO.

LINDBERG AIR AND HYDRAULIC DIV. • 1802 WILDWOOD AVE., JACKSON, MICHIGAN

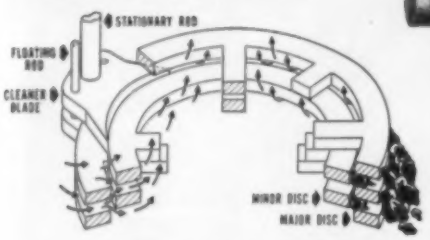
FILTRATION *Engineered** TO MEET HYDRAULIC APPLICATION NEEDS

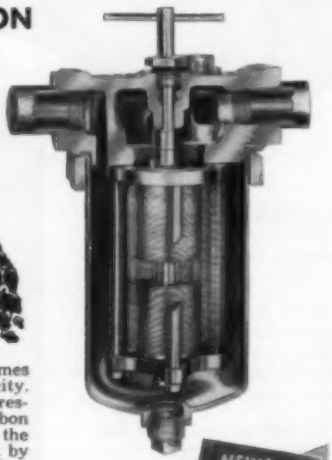
CUNO

A Complete Line of Filters Including

SUPER AUTO-KLEAN

- 40 MICRON FILTRATION
- PERMANENT ALL-METAL CARTRIDGE
- CONTINUOUSLY CLEANABLE





This metal-edge type filter is many times smaller than other types of equal capacity. Features high flow rates (to 50 gpm), low pressure drop, *no* pressure drop build-up. Carbon or stainless steel construction. As shown in the diagram, major discs, spaced 0.012" apart by the minor discs, stop all larger particles. Smaller particles down to 40 microns are positively stopped between the edges of the major and the minor discs.

* Because no *one* type of filter is best for every need, Cuno — and *only* Cuno — offers you a truly complete line that includes *several* distinct types of filtration media. And because every filtration system must be specified and engineered to individual job requirements, Cuno also offers you a complete application engineering service through Cuno Systems Engineers. Conveniently located in your area, one of these specialists is ready and fully qualified to help you select the filter type and model exactly right to solve your problems.

WRITE NOW FOR COMPLETE INFORMATION . . . *Your free copy of Super Auto-Klean Bulletin No. SAK-057 will be sent to you by return mail.*

CUNO ENGINEERING CORPORATION
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EDGE-TYPE, WIRE-WOUND, FIBER CARTRIDGE and POROUS METAL FILTERS

Filtration Engineers in Principal Cities

LETTERS to the editor

Here's our order for 20 copies.
The Goodyear Tire & Rubber Company

Send us 10 copies.
George L. Nankervis Co.

Corrections for the Product Selection Guides

The Product Guides published in January were compiled from 892 product questionaires returned by 424 companies. Every effort was made to avoid errors in this valuable reference material—and we were apparently quite successful. We would appreciate your clipping this column and stapling it to your January issue.

***Greer Hydraulics Inc.**—In the Accumulators Guide, pages 88-89, we erroneously called this company Greer Industries, Inc.*

***New York Air Brake Co., Watertown Div.**—This division is the manufacturer of the piston pump charted on pages 128 and 129. We incorrectly show the Kalamazoo Division on these pages.*

***New York Air Brake Co., Kalamazoo Div.**—This company manufactures the widely used Dudco vane type pump. Please add this company to the list of manufacturers on pages 130 and 131.*

***Carbide & Carbon Chemicals Company**—This company does supply synthetic hydraulic fluids for aircraft use. Guide on page 160 shows them as being a supplier for industrial applications only. Please make this correction.*

***Galland-Henning Mfg. Co., Nopak Div.**—On the Air Cylinder Guide, pages 90-91 please add dots to indicate that this company makes cylinders over the complete range of sizes from 1½ to over 14 inches.*

***The Garlock Packing Company**—Add, on page 121, a dot under cup sizes $\frac{7}{16}$" to 4". Garlock manufactures all sizes of cup packings shown on the chart.* ▼▼▼

A PROBLEM
IN HYDRAULIC
CONTROL?

call the man from Webster

On America's leading tractors, Webster Hydraulic pumps have proven themselves a winner. They stand up better to such tough, demanding day after day abuse. When your hydraulic application calls for proven stamina to resist shock, with a reserve of quick response and compactness of overall design . . . be it for farm equipment or power shovels, then the man from Webster can help. Let him tell you about the complete Webster line of over 100 different positive displacement gear type pumps and fluid motors.

Write or call the man from Webster — a good man to have on your design team.

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC
MELROSE 3-3611
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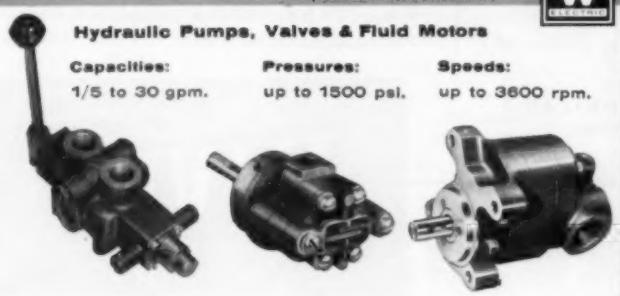
Hydraulic Pumps, Valves & Fluid Motors

Capacities:	Pressures:	Speeds:
1/5 to 30 gpm.	up to 1500 psi.	up to 3600 rpm.



FRANKLIN ADV. H102

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☐ *Complete hydraulic catalog of pumps and valves*

☐ *New information or data as published*

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Title _____
Company _____
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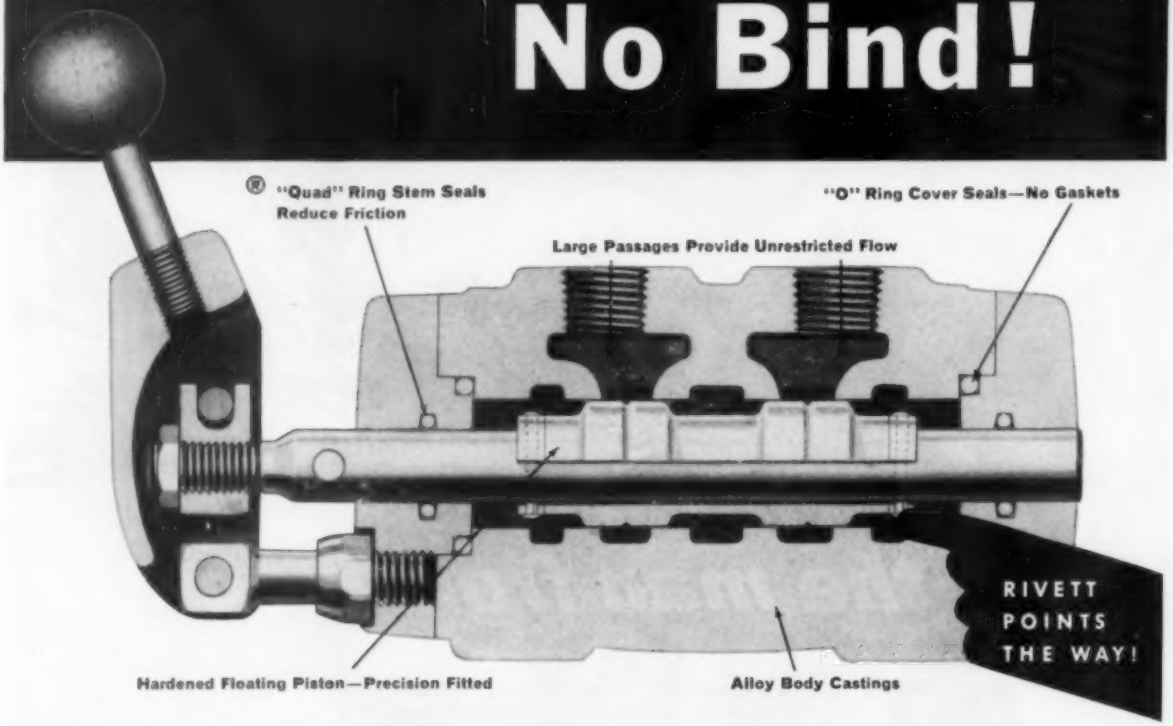
City _____ State _____

No Stick! No Bind!


® "Quad" Ring Stem Seals Reduce Friction
"O" Ring Cover Seals—No Gaskets
Large Passages Provide Unrestricted Flow
RIVETT POINTS THE WAY!
Hardened Floating Piston—Precision Fitted
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-with Floating Piston!

Valve Stem is Independent of Valve Bore in Rivett Hydraulic Pipe Mounted Valves

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1607 VALVE SELECTIONS!

Types: Hand, foot, cam, solenoid, pilot, oil pressure, air pressure, flow control, check, deceleration, relief, unloading, sequence, counterbalance.

Sizes: ¼", ⅜", ½", ¾", 1", 1¼", 1½".

Actions: Standard, spring-return, spring-centered, ball detent.

Mountings: Pipe mounted; panel mounted.

P.S.I.: 1500 P.S.I.; 3000 P.S.I. oil service.

Piston designs for any circuit.

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Brighton 35, Boston, Mass.

THE BETTER YOU KNOW HYDRAULICS THE BETTER YOU LIKE

Get Catalog No. 204 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

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Wherever your machinery is shipped . . .

the performance and the name are the same around the world!

FOR YEARS SHELL TELLUS OIL has been top-rated as both a lubricant and a control fluid for complex hydraulic systems. Its ability to combat foaming, oxidation, rust, sludge-formation and wear has earned it nation-wide popularity.

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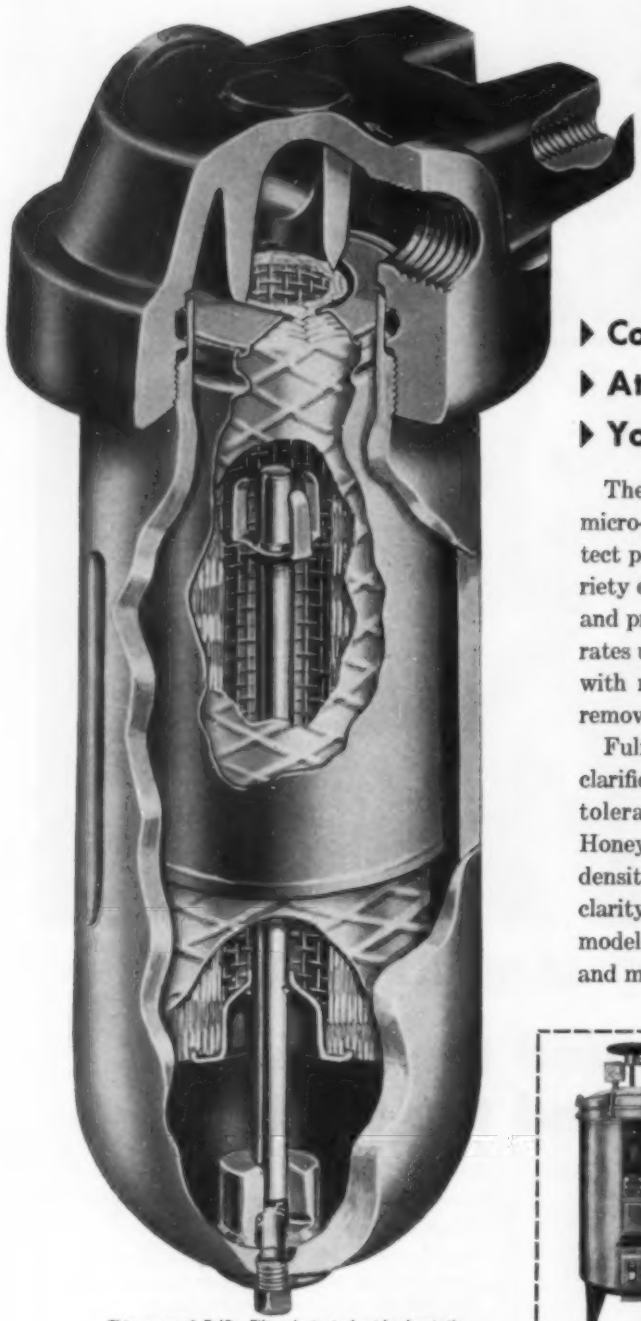


This rugged Fulflo Filter is tested at hydrostatic pressure of 10,000 pounds per square inch — to assure safety at operating pressures up to 4000 psi.

USE Fulflo FILTERS WHEN YOU WANT

- Continuous Micronic Clarity
- At the Flow Rate and Pressure
- Your Operations Require

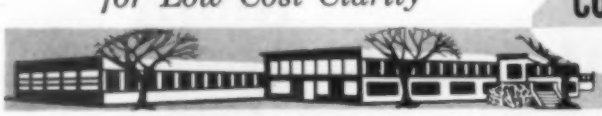
There's a Fulflo Filter to meet your exact needs for micro-fine filtration of any hydraulic fluid — to protect precision parts and extend fluid life. A wide variety of standard models handle all normal flow rates and pressures. Special models are engineered for flow rates up to 2000 gpm or pressures as high as 5000 psi, with minimum pressure drop. Fulflo Filters do *not* remove additives from oils.

Fulflo Filters are especially designed for micronic clarification of fluids used where exceptionally precise tolerances are involved. Fulflo Filters employ Honeycomb Filter Tubes in a wide range of controlled densities to give you the exact degree of micronic clarity you need. For specific applications, special models can be engineered in a variety of sizes (single and multi-tube), containers and elements.

The complete line of Commercial Filters products includes CFC (formerly Honan-Crane) Hydraulic Oil Purifiers. Filter medium is Cranite (Fuller's earth) for removal of soluble impurities as well as abrasive solids. CFC Purifiers quickly pay for themselves by reducing oil consumption, preventing excessive wear of hydraulic parts, and safe-guarding against clogged valves and pistons.

Commercial Filters Engineers are ready to help you with any problems involving fine filtration of hydraulic fluids. For technical literature, write to Department AH.

Micro-Fine Filtration for Low Cost Clarity

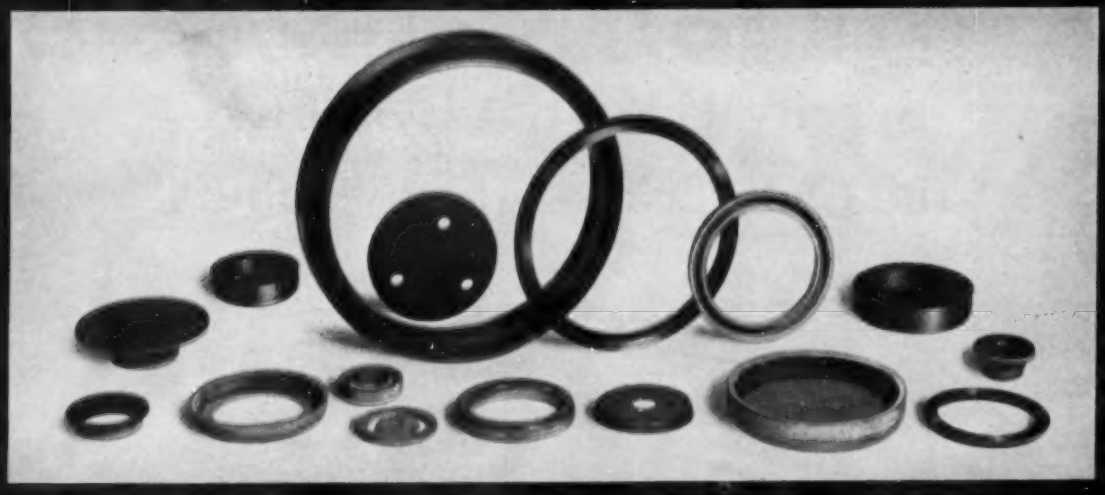


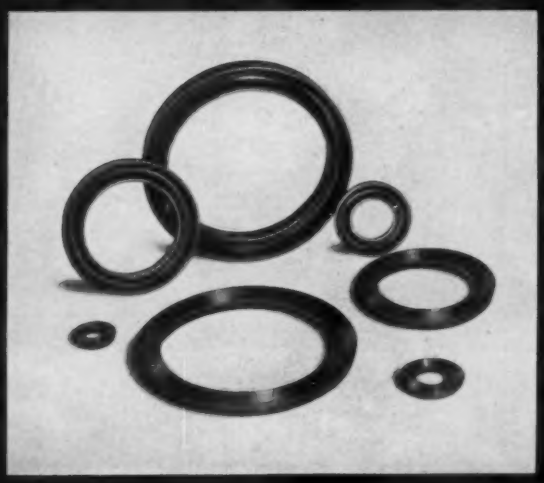
COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS





G & K LEATHER and SYNTHETIC PACKINGS . . . for all industry

Graton & Knight . . . the world's largest manufacturers of Industrial Leathers, pioneered the manufacture of mechanical leather packings.

Today, in addition to complete facilities for these leather packings, G & K can furnish synthetic packings . . . cups, flanges, U's, V's, etc. *More*, G & K offers a complete line of synthetic O-rings.

For your mechanical sealing problems, check with your G & K representative.

* * * * *

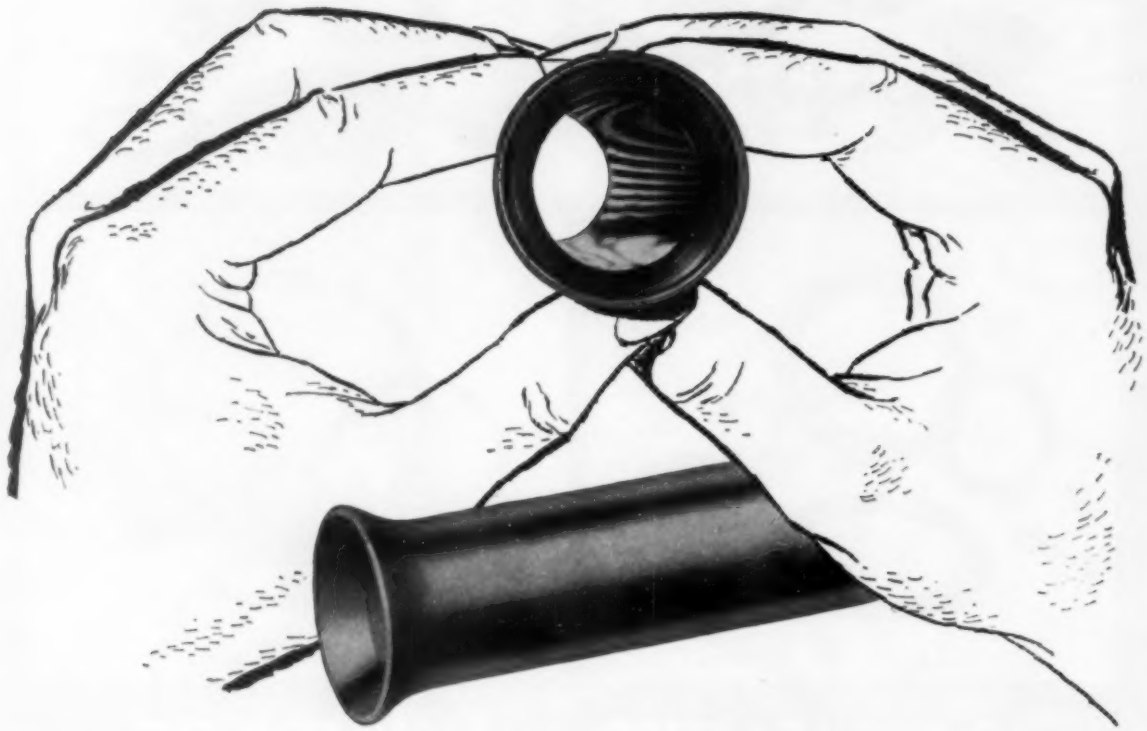
GRATON AND KNIGHT

GRATON & KNIGHT *Company* INC.

WORCESTER, MASSACHUSETTS

Circle 67 on Reader Service Card

Cut Hydraulic Flow Resistance . . . Specify HYDRALUSTER the Only "rifle-barrel" Tubing



AXIOM: The smoother the surface, the less resistance offered. And here you see the inside of a section of HYDRALUSTER tubing . . . photographic proof of a super-smooth surface.

Hydraluster is a cold-reduced, carbon steel tube for hydraulic and diesel application. Its exclusive finish is the reason that systems using Hydraluster are developing the highest rates of power efficiency and reaction time.

Hydraluster has other advantages to offer the Original Equipment Manufacturer. Hydraluster is highly resistant to oxidation, even under the conditions imposed by the newest, high-speed fluids. The result is greatly improved maintenance records. And the bright exterior finish of the tubing adds to the appearance and sales appeal of precision machinery.

Produced in standard hydraulic sizes, Hydraluster is a premium tube sold at standard hydraulic tubing prices.

SAMPLES and SPECIFICATIONS: Make the "rifle-barrel" test yourself. Your name on a company letterhead will bring specifications, literature and a sample of Hydraluster by return mail.

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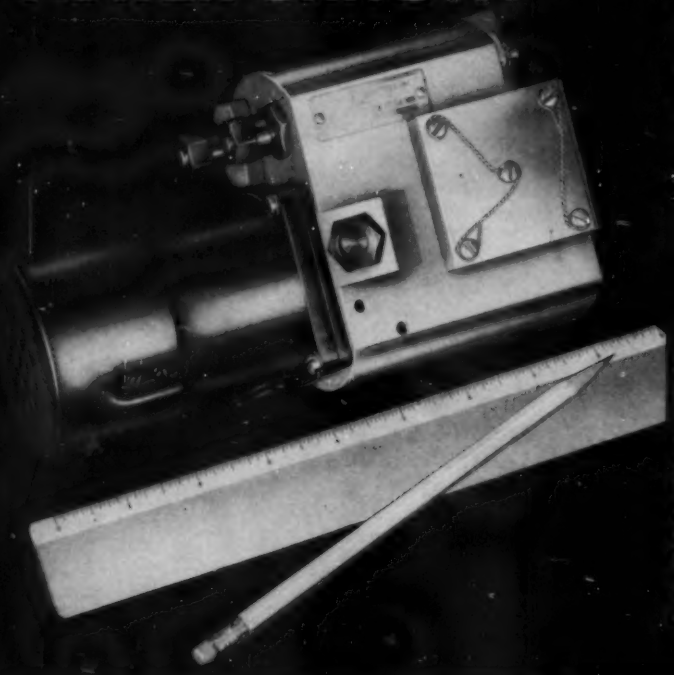
Circle 152 on Reader Service Card

Circle 52

AIRCRAFT-TYPE
hydraulic
POWER UNITS . . .



To supply dependable hydraulic power for critical applications, Eastern units are engineered to perform under extreme conditions. Compact design and varying motor sizes make them unique power sources, especially desirable for airborne use. The equipment illustrated in detail presents a typical Eastern Power Unit designed for one application. Many other requirements can be satisfied with designs of this general type.

Unit consists of: positive-displacement pump, electric motor drive, oil reservoir, expansion chamber, porous bronze ten-micron filter, pressure regulating valve, filter relief valve, and expansion relief valve.

SPECIAL UNITS to be built into Servo Systems and specialized projects are available. As illustrated below, Actuators combined Servo-valve and Actuator, and Servo-valve Hydraulic System combinations are being produced by Eastern for custom-specified jobs. If your project involves equipment of this type, write to us for further information.

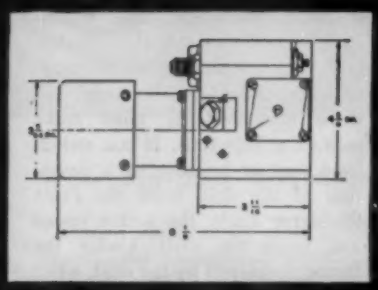
Specifications:

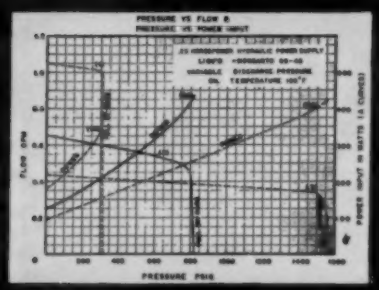
Available with either 1/8, 1/4, or 1/2 horsepower motor, in 28 V. D.C. or 400 Cycles 3 Phase power.

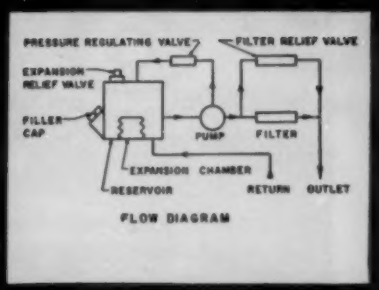
Available with various pump characteristics. Under certain operating conditions, units can be made self-cooling. *Example:* 1/4 H.P. Unit has a continuous-duty oil-temperature rise above ambient of approximately 60° F. at sea level.

Pressure range from 0 to 1500 PSIG with compatible flow.

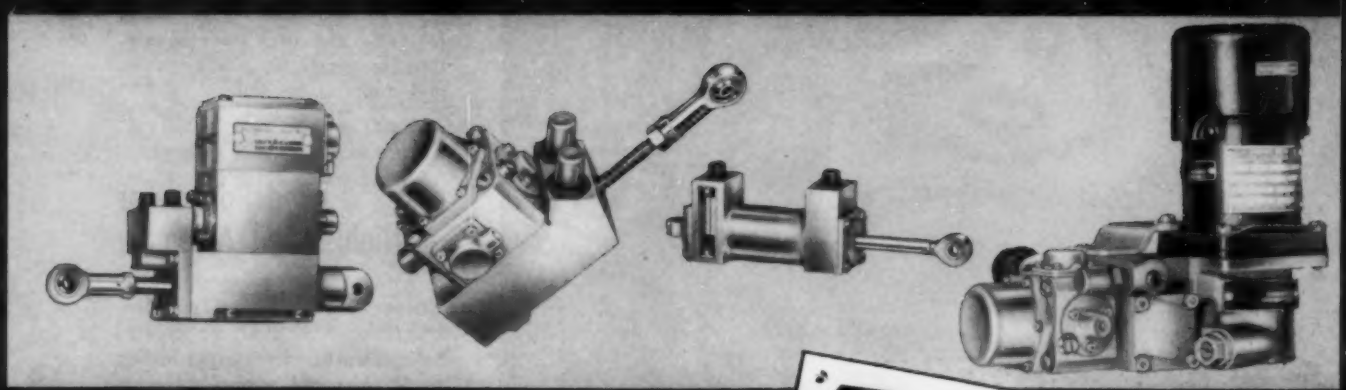
Anodized aluminum body contains all components except motor.







FLOW DIAGRAM



☆ *Write for Aviation Products Catalog 340*

Eastern
INDUSTRIES, INC.
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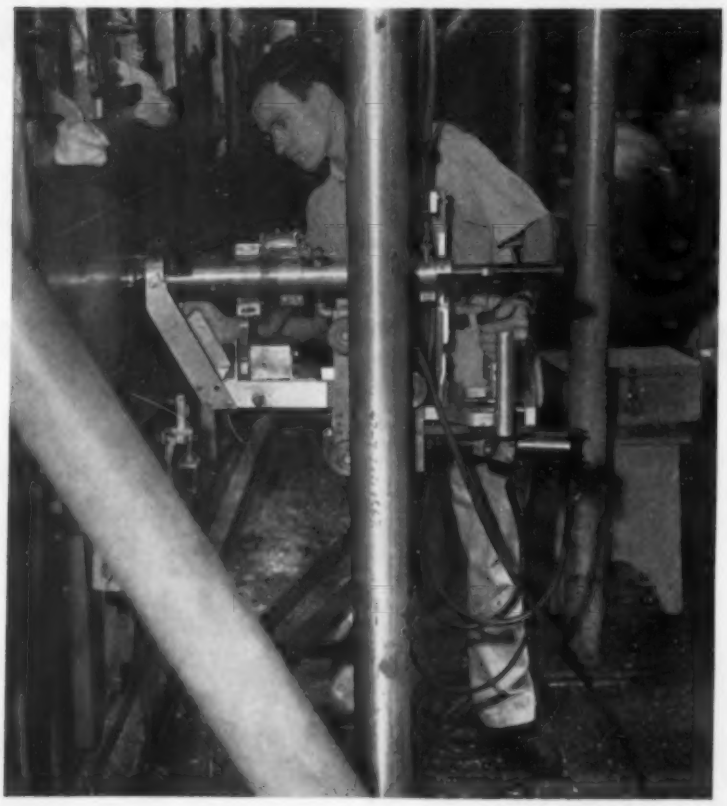
BRIEFS about fluid power

PNEUMATICS FOR SPEED AND ACCURACY

For an aircraft application requiring extremely accurate countersinking and complete maneuverability, engineers at Glen L. Martin Company chose pneumatics. A standard Airfeedrill was placed in a housing which gave it universal movement in the working area, and a self-aligning device was added near the working end of the drill. Required accuracy was secured and the time required for this operation was reduced about 75 percent.

• **Accuracy**—The wing-skin and fuselage of a high speed jet plane contain thousands of flush-driven flat-head rivets and screws and each hole must be countersunk to a very close tolerance.

• **Self-aligning**—This feature consists of a gimbal attached to a standard Airfeedrill. It is composed of a metal ring approximately 6 inches in diameter and holder for the drill. Three microswitches, located in the nose of the drill holder, control a solenoid which actuates the on and off operations of the drill.



Unit is supported by arms from a base. A magnet for locking the drill in position, and an air cylinder for pressing the unit against the frame, are contained in this base.

• **Operation**—The operator moves a vertical handle actuating the air cylinder, which presses the unit against the skin and causes the drill to move to a 90-degree normal position. The microswitches contact the skin during this operation and actuate the magnet and solenoid. However, all three microswitches must make contact at this time. If one switch loses contact because of a deviation of the drill from the exact 90-degree angle, the switch opens and stops the drill. Under the thrust developed by the drill, when the proper depth hsa been reached a pressure pad on the countersink forces the unit away from the skin, thus opening the microswitches and stopping the drill. ▼▼▼

Fluid Power For High Speed Assembly

Without costly investment in custom fixtures, Wilton Tool Manufacturing Co. used air-powered hydraulics to increase production on high speed assembly operations. Their PowRarm provides in-

Continued on page 32

TEST PROVES C/R MOLDED CUP

Conventional leather cup. Note rounded shape and thinness of material at heel.

C/R *molded* leather cup. Note sharp angle and full thickness of material at heel.

New molded C/R cups* stand up longer... cut down replacement costs

Compare the wear on these piston cups shown in the unretouched photographs above. They were tested in a hydraulic cylinder at 6000 p.s.i. for 3000 cycles. The one at the right is a Sirvis-Conpor molded leather cup. The other is a conventional leather cup. Features of the C/R molded cup that make it so obviously superior are greater density, the sharp, rather than rounded heel, and the fact that it is pre-formed to the shape which conventional cups are forced to assume under pressure. This eliminates operational stress and flexing that conventional cups undergo, and contributes greatly to longer service life.

Right now, molded C/R cups are providing greatly increased service life in hydraulic cylinders in such heavy duty applications as farm and road building equipment and steel mill equipment at oil pressures up to 3500 p.s.i., and 150 p.s.i. in air cylinders. If you face a difficult packing problem that requires high durability and efficiency . . . it will pay you to consider this new, improved C/R design.

*Available in J.I.C. standard and other popular sizes. Write for complete size list.

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue Chicago 22, Illinois

Offices in 55 Principal Cities. See your telephone book.

In Canada: Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York

SIRVIS C/R DIVISION
CHICAGO RAWHIDE

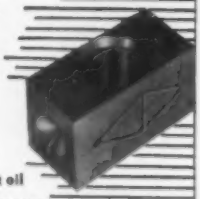
Other C/R Products

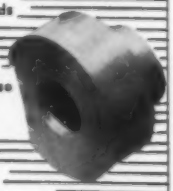
C/R Shaft & End Face Seals • Sirvene (synthetic rubber) molded pliable parts • C/R Non-metallic Gears

Promet Engineered Bronze
BEARINGS
BUSHINGS
WEARING PARTS
GUARANTEE
SUPERIOR
SERVICE
Or Your Money Back!

Special formulas developed for specific or unusual conditions. Will not cut or stick to the shaft under ordinary operating conditions. Carry on during temporary lubrication failures. Absolutely will not powder in severest service.

Highest quality machining to precisely controlled tolerances. Difficult oil grooving . . . smooth grooves, even around acute bends . . . no sharp edges or burrs . . . remarkably better lubrication. Also available rough cast.





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The American Crucible PRODUCTS CO.
"Bearing Specialists Since 1919"
1303 Oberlin Avenue, Lorain, Ohio, U.S.A.

Please send free literature and service data sheets on Promet Bronze.

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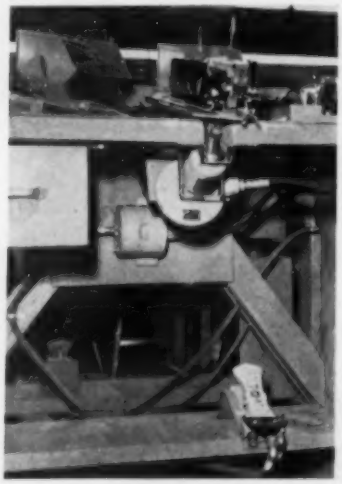
BRIEFS continued

stant positioning of work pieces to any desired angle and leaves both of the operator's hands free.



• **Components**—Unit consists of a work positioner, an air-hydraulic booster cylinder, foot pedal control, and necessary hoses and fittings. The hydraulic booster, supplying the locking force, operates off the factory air line at 60 to 100 psi.

• **Advantages**—Complete assembly can be quickly installed on any work bench or station. Work weight capacity is 105 pounds at 100 psi air input. This device can be applied to a wide range of assembly operations. ▼▼▼

7th National Materials Handling Conference

In conjunction with the National Materials Handling Exposition, the 7th National Materials Handling Conference of the American Material Handling Society, will be held in Convention Hall, Philadelphia, Pa., April 29th through May 3rd. About 250 companies will exhibit,

Continued on page 34

BRIEF NOTES

SMALLER FACTORIES, BUT MORE PRODUCTION . . . According to Ralph E. Cross, executive vice president of the Cross Company, this will be possible with atomic power and the flexibility of automation. His company is a large producer of special machines and makes extensive use of fluid power.

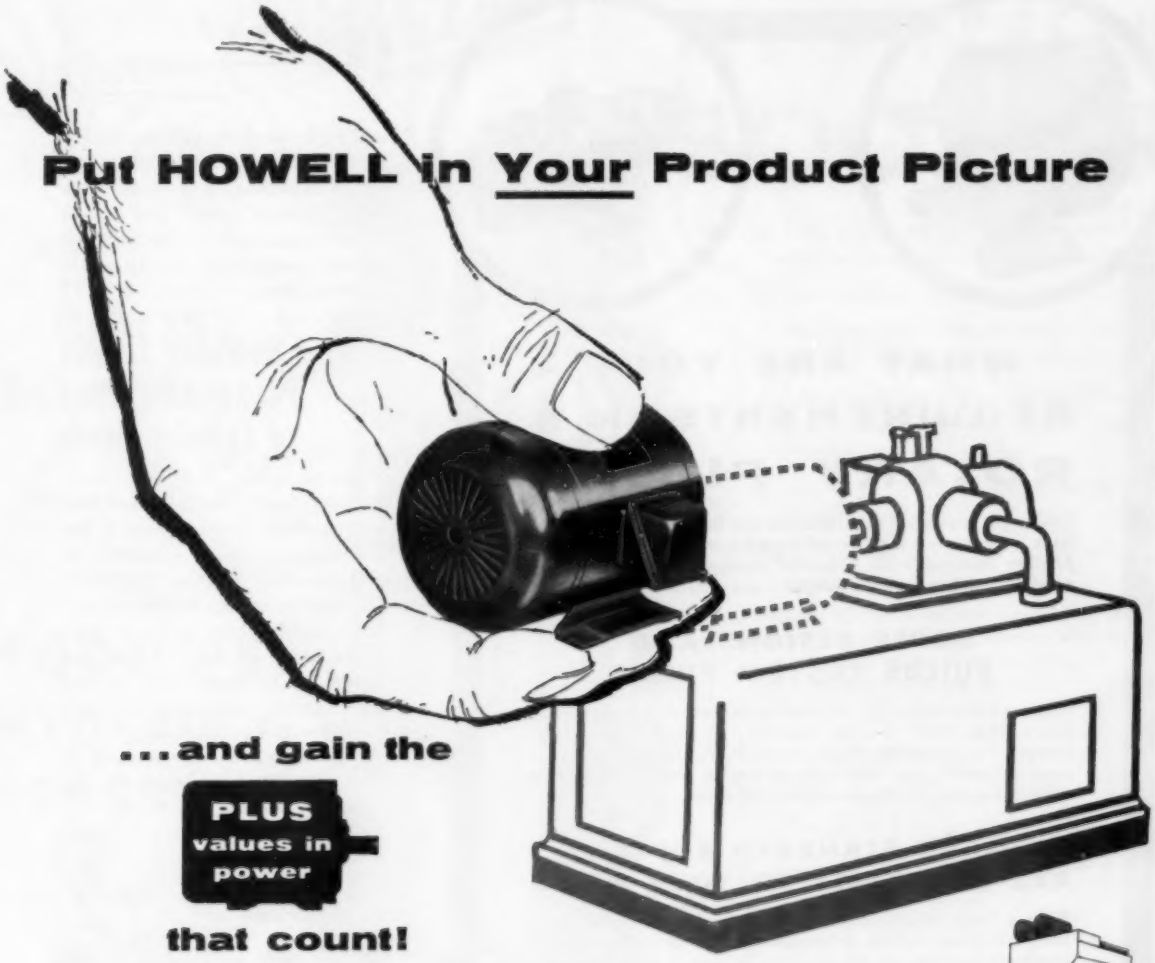
HYDRAULICS STILL IN ITS INFANCY . . . Continued rapid expansion of the hydraulics field was predicted by David J. Munroe, president of Webster Electric Company. His firm expects over 10 percent increase in business this year, mostly in hydraulic equipment.

EXTREME SERVICE VALVE . . . Developed by Marotta Valve Corporation, this small solenoid valve controls air at 1000 F under 4,000 psi. See description in New Products section.

WELDED VERSUS THREADED PIPE . . . H. A. Sosnin of Tube Turns points to a trend toward welding lines from 1/2-inch up. Lower cost, improved flow conditions and reduced maintenance are achieved.

STEEL O-RINGS FOR AIRCRAFT . . . Tomorrow's jets will encounter increasingly higher temperatures. Research by Republic Aviation and other aircraft manufacturers indicates that stainless steel O-Rings can be used as a face seal in cylinders and valves operating at 500 F and higher.

Put HOWELL in Your Product Picture



...and gain the

PLUS values in power

that count!

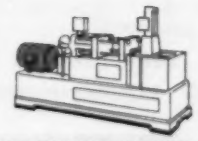
No matter how efficiently designed your hydraulic equipment may be, in operation its dependability rests . . . year in and year out . . . on the motors you select to power it. That's why manufacturers and users of hydraulic machinery, from simple pumps to the largest presses, are specifying Howell motors in ever increasing numbers. Here are a few of the reasons:

EXTRA DEPENDABILITY that challenges the years. Howell's new principle of heat-source ventilation . . . double sealed bearings . . . tough rolled steel frames and precision fitted cast iron end plates . . . these and many more are plus values that *count!*

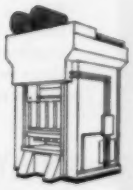
AN UNSURPASSED REPUTATION for engineering excellence and quality manufacture . . . built up by Howell in over 40 years of serving industry's motor requirements.

TOPS IN APPEARANCE. No other industrial motors have such smooth, unbroken contours . . . without an external fin or rib to mar their looks or catch dust deposits.

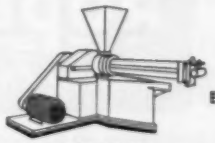
Howell makes virtually every type of AC industrial motors . . . fractional and integral to 300 hp, in all standard enclosures, in both rerated and non-rerated frame sizes, and in many pump mountings. Howell part winding motors, for economical reduced voltage starting of pumps may be of special interest to you.



DIE CASTING MACHINES

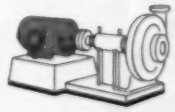


HYDRAULIC PRESSES



EXTRUDERS

HYDRAULIC ELEVATOR UNITS



FLUID TRANSMISSION PUMPS

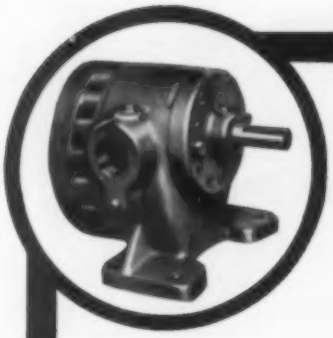
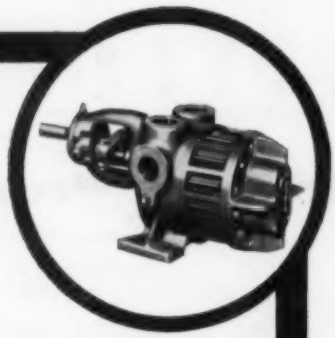
Howell motors are specified and used by these leading manufacturers of hydraulic equipment:

The Denison Engineering Co. • Hydraulic Press Manufacturing Co. • Rotary Lift Co. • Globe Hoist Co. • Borg-Warner, Inc. Hansen Manufacturing Co. • Ex-Cello-O Corporation

A Howell sales engineer can give you valuable assistance on any motor application. Wire or 'phone collect . . . or drop us a line . . . you'll get prompt action. Howell Electric Motors Co., Howell, Michigan.

HOWELL *motors*

. . . precision built for industry since 1915

WHAT ARE YOUR REQUIREMENTS IN A ROTARY PUMP?

Today perhaps your requirements are for *hydraulic applications* . . . next week for *processing equipment* . . . next month for *pressure lubrication* on industrial equipment. Whatever the need, Roper has the *right pump* for you—to do the job better!

ROPER DESIGNS AND BUILDS CUSTOM PUMPS

Roper's basic principle employing two equal size pumping gears lends itself to wide flexibility in designing custom pumps. You name the P.S.I., the G.P.M., the port arrangement required, plus other data and we'll work with you in developing rugged, dependable equipment.

MANY STANDARD ROPERS ARE ADAPTABLE TO YOUR NEEDS

With a large selection of both standard and special units from which to choose, substantial savings in designing and engineering costs can be affected. A look at your specifications will tell us if such standard Ropers can be adapted or modified for your needs

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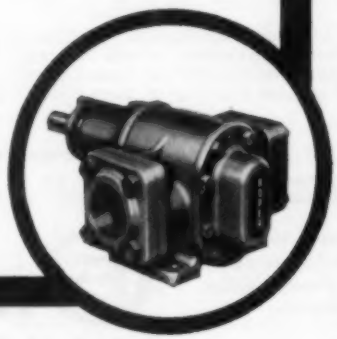
"HOW TO SOLVE PUMPING PROBLEMS"

ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION, 703 BLACKHAWK PARK AVE., ROCKFORD, ILL.



BRIEFS continued

and both the show and the conference will have as their theme, "Materials Handling, Key to Automation." Annual awards and honors will be presented at the Society's annual banquet on May 1st at the Bellevue-Stratford Hotel. ▼▼▼

Hydraulic Fingers Permit Alternating of Cylinder Heads

In designing this automotive cylinder head assembly and testing machine, Snyder Tool & Engineering Co. made extensive use of hydraulics. Machine automatically applies sealing compound and three welch plugs to three holes in the head; air tests for leaks and rejects faulty heads; and unloads the head and plug assembly on a conveyor line.

This machine is powered by two individual hydraulic power units.

• **Hydraulic operations**—Hydraulic powered plungers press the welch plugs into the cylinder heads. Heads are transferred between stations by a hydraulic powered, walking beam type nest.

An unusual feature is provided by the hydraulically operated fingers which move one head to one side of the machine and the following head to the other side. This permits alternately making right and left hand heads.

Rejected heads are removed from the line by six hydraulically operated overhead transfer bars. Repaired heads are returned to the line by the same means. Finished heads are unloaded onto a conveyor. ▼▼▼

Continued on page 36

Circle 136 on Reader Service Card

Circle 112

Miller

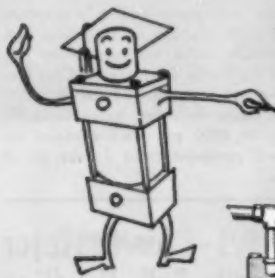
FLUID PRESSURE BOOSTERS

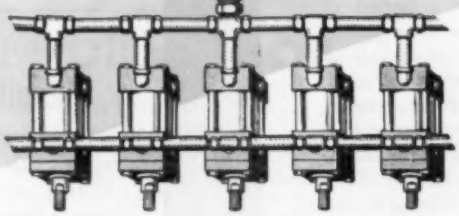
BOOST 80 PSI AIR

Input Range: 40 to 3000 psi Air or Fluid

TO 2000 PSI HYDRAULIC PRESSURE

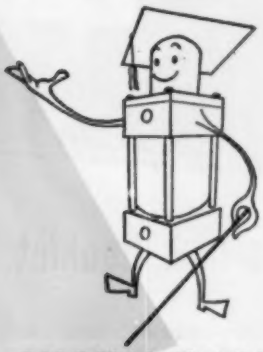
Output Range: 200 to 10,000 psi Fluid





- Save space, weight and investment cost by replacing pump installations in many applications
- Less costly to install, operate and maintain
- **Hold pressure indefinitely** without the motion and heat generation of ordinary pump circuits
- Provide—at point of cylinder thrust—more efficient power with less weight in less space than direct driven air cylinders
- Save up to 95% of air consumed by direct driven air cylinders
- Operate at speeds of 30 to 450 strokes per minute

NOTE: In addition to its most complete line of "Custom-Built" Boosters available on normal delivery, Miller offers 5" bore 25 to 1 ratio, boosters for immediate delivery in either 6" or 12" stroke. Write for data and prices.



ESPECIALLY RECOMMENDED FOR

- **WELDING**
- **PUNCHING**
- **SHEARING**
- **CLAMPING**
- **RIVETING**
- **CRIMPING**
- **PRESSING**

and similar applications

FULL DETAILS IN MILLER BULLETIN B-200 SENT FREE ON REQUEST

Other Miller products include: Air cylinders, 1½" to 20" Bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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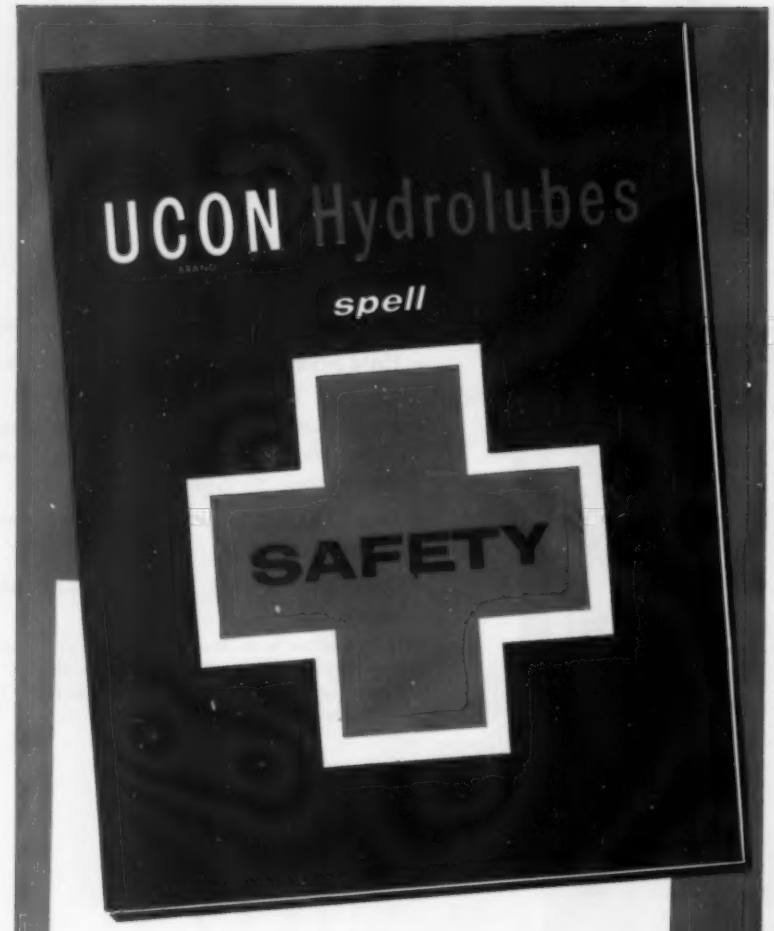
MILLER FLUID POWER DIVISION FLICK-REEDY CORP.

2008 N. Hawthorne Ave. • Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS



This new booklet . . .

. . . tells you how CARBIDE's UCON Brand hydrolubes spell safety for you, your plant, and your employees.

Yes, industrial experience over a period of more than 10 years has shown that the common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. So, why not find out how the fire-resistance, outstanding anti-wear characteristics, and corrosion protection of new and improved UCON hydrolube "CP"-type fluids can help spell safety for you. Write for "Ucon Hydrolubes Spell Safety," Form 40134.

CARBIDE AND CARBON CHEMICALS

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A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, New York

"Ucon" is a registered trademark of Union Carbide.

BRIEFS continued

Industrial Use of Molded Hydraulic Seals

. . . will be discussed by E. J. Parker at the March 29th meeting of the Fluid Power Division, ASME Philadelphia Chapter.

Parker is application engineer at Linear, Inc., and has an extensive background in the field of fluid power. He has patented a number of applications, and has written a series of articles for APPLIED HYDRAULICS on O-Rings which will be published in the May, June and July issues. ▼▼▼

Hydraulic and pneumatic safety valves up to 8 x 10 size can be tested on this semi-portable valve testing station developed by Farris Engineering Corporation. An air-powered, 60 to 1 ratio, booster pump furnishes hydraulic pressure up to 6000 psi. Unit contains air tanks and compressors to deliver air at 500 psi.

Air Conveyor Permits Bulk Handling

A pneumatic conveyor system allows this bakery which is not located on a railroad siding, to take advantage of bulk rail shipments. In this air conveyor system, designed by The Fuller Company, subsidiary of General American Transportation Corporation, the only thing that moves is the bulk material.

• **Air lift**—Two motors on the ground floor of the transfer house power the system. A 40 hp motor

Continued on page 40

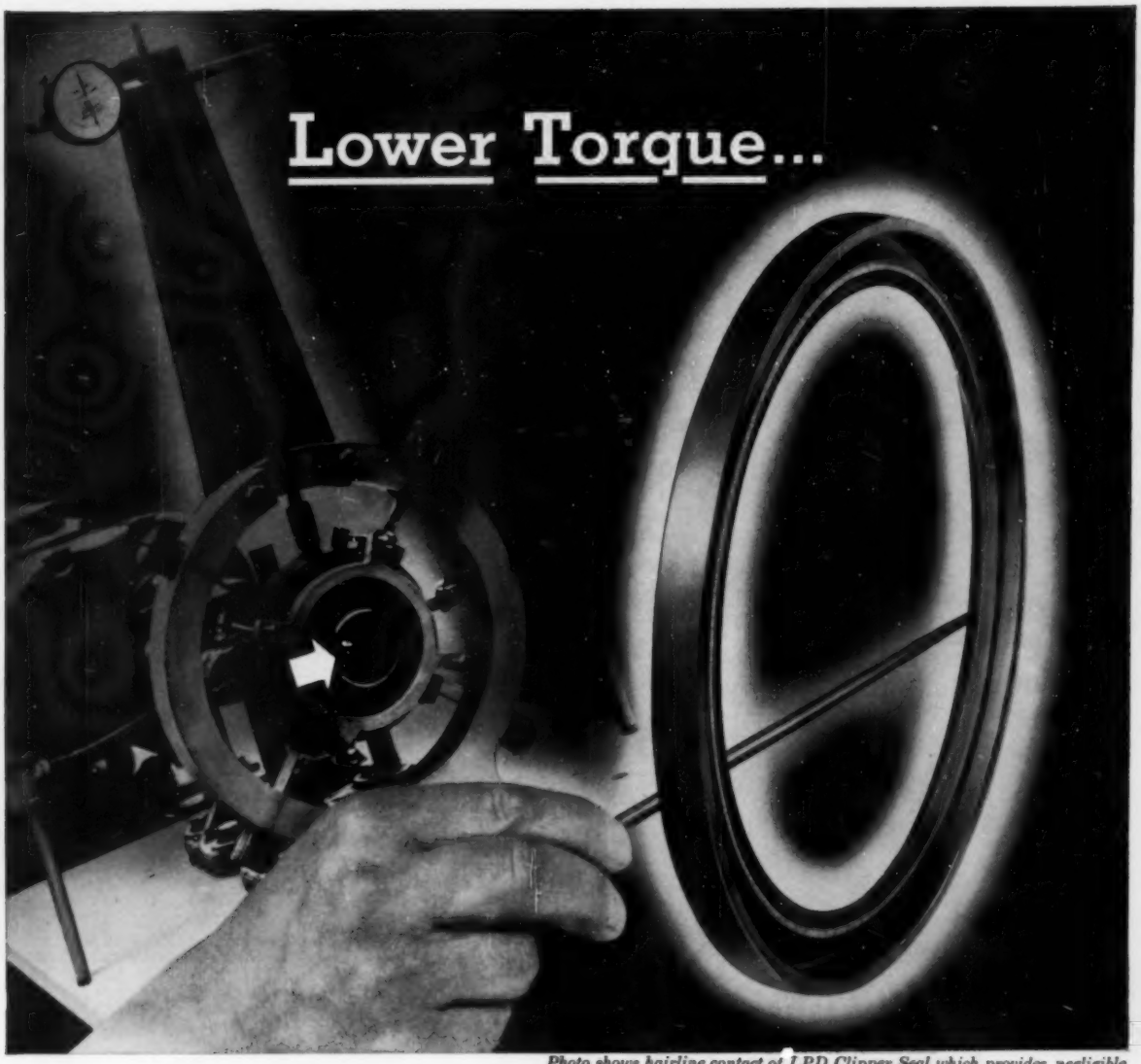


Photo shows hairline contact of LPD Clipper Seal which provides negligible torque when seal is tested on dry run of torque measuring apparatus.

How J-M Clipper Oil Seals cut shaft drag

line contact minimizes interference... provides cooler running

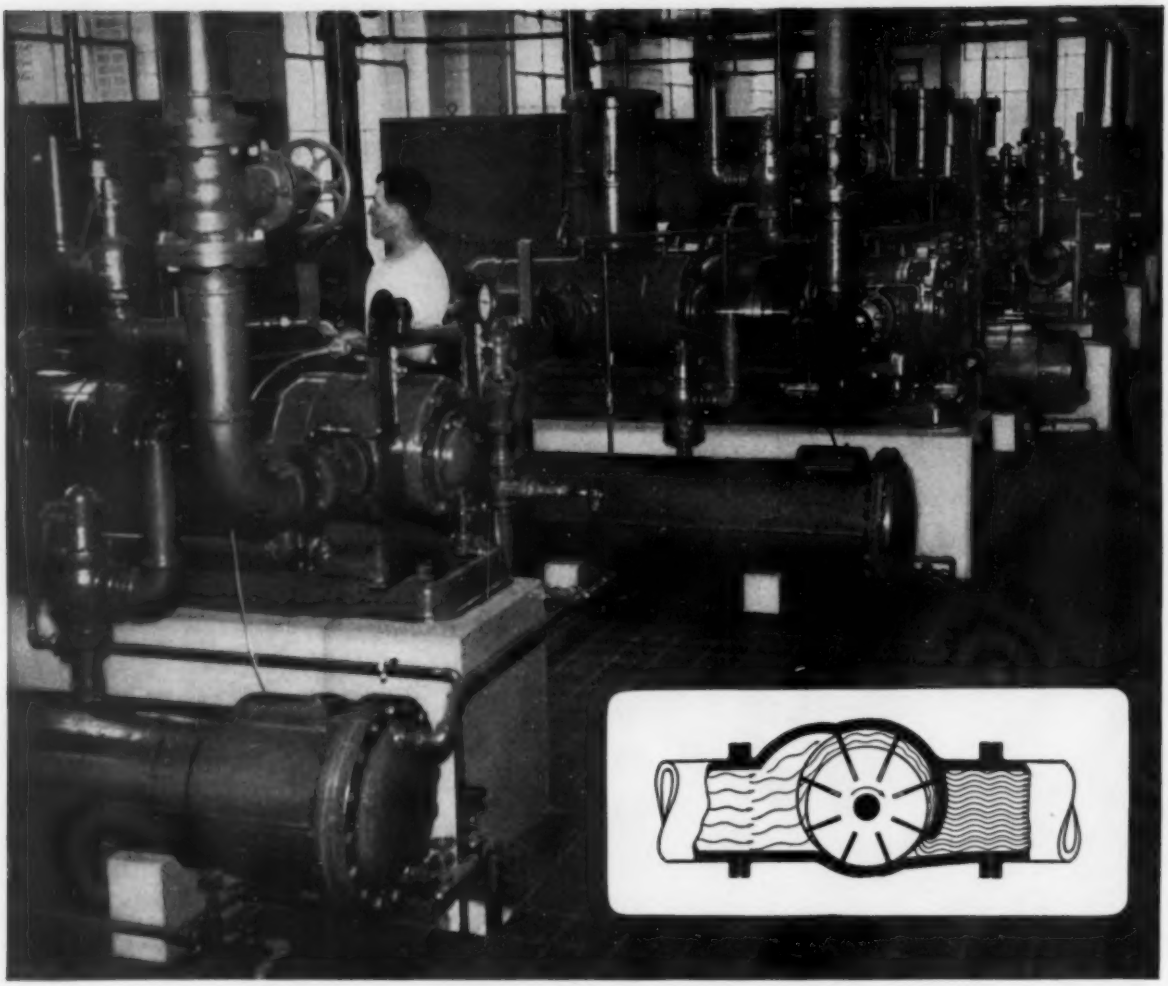
Take a close look at the lip of a Johns-Manville Clipper Seal. You'll see how the bearing area has been narrowed down to a sharp line contact. That's why you get less power consumption and lower operating temperatures when you use Clipper Seals to seal in lubricant, seal out dirt.

What's more, this line contact requires less lubrication and yet receives far more in proportion to its surface than any other design. It all adds up to greater sealing efficiency and longer seal life for Clipper Seal users. This exclusive line contact feature is provided on all LPD Clipper Seal designs which are adaptable to most applications.

Lower torque is only one of many advantages you get with J-M Clipper Seals. Precision moulded from a variety of corrosion-resistant compounds specially developed for each service, they provide maximum sealing ability, long life, wide adaptability and easy installation. For more information on the complete line of Clipper Seals, write for new 28-page illustrated brochure PK-71A. Address Johns-Manville, Box **14**, New York 16, N. Y. In Canada: 565 Lakeshore Road East, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CLIPPER SEALS



Industrial Pressures Up To 125 psig
Capacities to 3300 cfm

When you need such performance, it will pay you to specify Fuller vane-type Rotary Compressors. They provide the simplest, most economical and most reliable source of compressed air for all pneumatic plant services.

These compressors have a minimum number of moving parts, (rotor, blades and bearings) employ direct-connected motor drive, and operate with an incredible lack of vibration. They run for days without requiring operational attention, and are ideal for continuous service in out-of-the-way locations.

Detailed information on design characteristics, and typical applications will be forwarded promptly on request.

Fuller
. . . . pioneers in harnessing AIR

FULLER COMPANY, 142 Bridge St., Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
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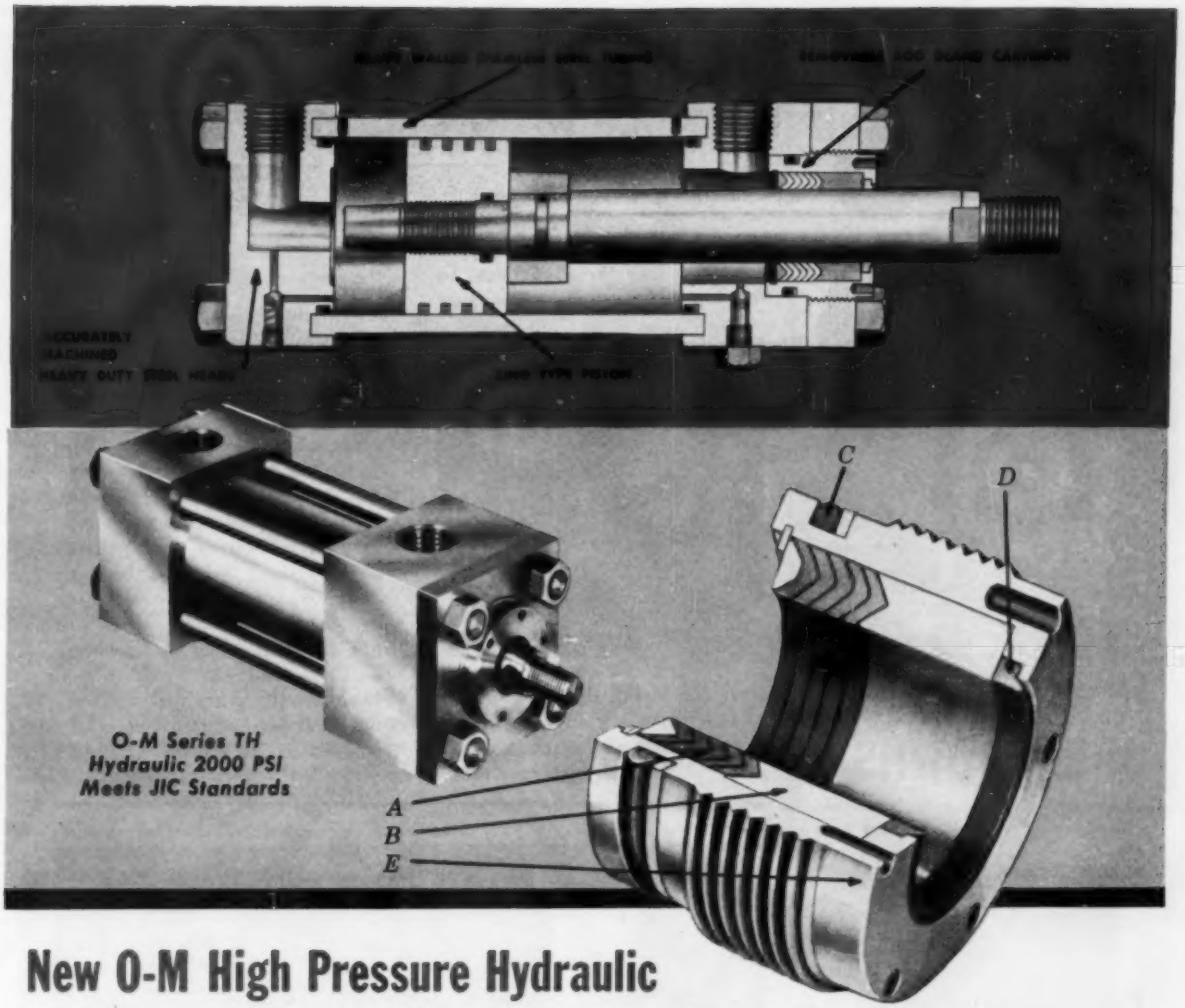

O-M Series TH
Hydraulic 2000 PSI
Meets JIC Standards

New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge

The O-M-engineered removable Rod Gland Cartridge, exclusive with the O-M Series TH Hydraulic Cylinders, incorporates all the features essential to peak performance and minimum maintenance. It is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

A ***Rod Packing*** — Vee type, non-adjustable, self-compensating, rod gland packing provides multiple lip seal with excellent pressure sensitivity and long life.

B ***Rod Bearing*** — Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

C ***Cartridge "O" Ring Seal*** — With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

D ***Rod Wiper*** — Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

E ***Pilot*** — O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders — conservatively rated at 2000 P.S.I. — are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are included in the new O-M Bulletin 105. Mail coupon for your FREE copy today.

ENGINEERING SERVICE — consult an Ortman-Miller representative regarding your hydraulic or pneumatic problems. His broad experience with standard and special cylinder applications is available to you without obligation. Use convenient coupon.

ORTMAN-MILLER MACHINE COMPANY
1 143rd Street, Hammond, Indiana

☐ Have representative call. ☐ Send Bulletin 105.

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TAKE IRON OUT

of Hydraulic Systems

and

REDUCE the RISK of BREAKDOWNS

with

FERROFILTER

Permanent Magnet Separators

A stack of soft steel grids (one grid shown above) is magnetized by powerful permanent magnets. The strong magnetic pull, adjacent to hundreds or thousands of feet of grid edges, catch and hold extremely fine ferrous particles which, otherwise, would wear or score precision fitted parts . . . make valves stick or clog small openings.

Write today for BULLETIN PM-65

S. G. FRANTZ CO., Inc.

Brunswick Pike & Kline Ave.
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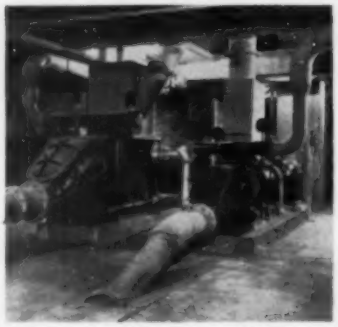
BRIEFS continued

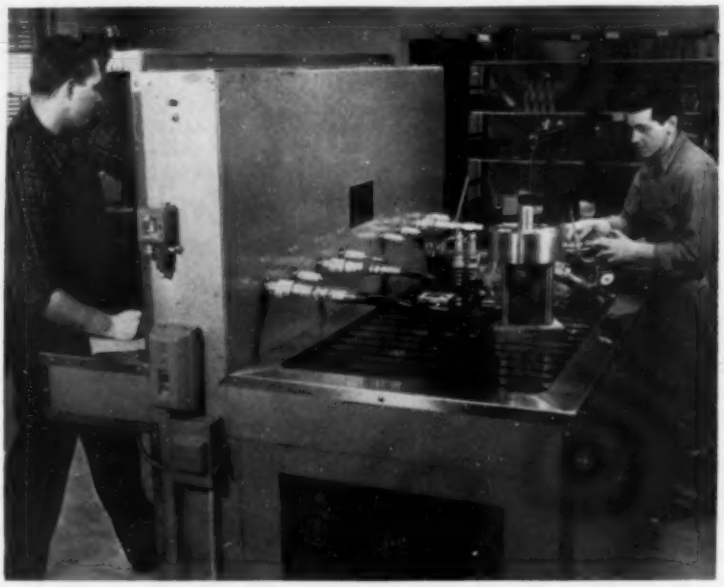
creates the suction of about 5 pounds which empties the hopper cars and lifts the ingredients to the top of the house. Dropping



from the top to the ground floor of the house, the ingredients are sifted, filtered and weighed as necessary. Then a 60 hp motor blows the materials from the transfer house to the bins in the silos in the storage building.

● **Advantages**—Pneumatic conveyors are often quite economical to operate, since only the product moves. Materials can be conveyed up, down, underground, through walls, around corners—any place that pipes can be run. Air systems are self-cleaning and offer maximum protection against contamination, infestation, and the hazards of dust. Blending, batching and weighing can be done en route. Any type of dry, or at least non-sticky, granular or pulverized bulk material can be handled. Even lumpy material up to 2 inches in size has been successfully handled by air. ▼▼▼

Continued on page 42



Hydraulic test bench incorporates functions of several devices in one compact unit for leak, hydrostatic pressure, flow and cycling tests of components used in hydraulically operated circuit breakers. Unit has flow capabilities to 500 gpm with standard pressures from 0 to 5000 psi and can provide hydrostatic pressures up to 20,000 psi. Its pressure switches and relief valves can be accurately preset and gauges calibrated for accuracy. Water-cooled heat transfer units permit continuous operation indefinitely without overheating. Bench was designed and installed by Allis-Chalmers engineers in cooperation with Hydraulic Engineering Co., Brookline, Mass.

Aeroquip Hose Lines with Reusable Fittings —the Answer to Hydraulic Design Problems

HUNTINGDON INDUSTRIES USES AEROQUIP ON AUTOMATIC ASSEMBLY MACHINERY

Aeroquip Hose Lines simplify fabrication of complex hydraulic systems on automatic partition assembling machinery made by Huntingdon Industries, Meadowbrook, Pa. With Aeroquip Bulk Hose and Reusable Fittings, Huntingdon personnel assemble hose lines of any length quickly, easily, using ordinary bench tools.

Simplify your hydraulic design problems with these Aeroquip Hose Lines: 1509 Hose for petroleum and water base systems up to 5000 psi.; 1503 and 1502 Hose for petroleum and water base systems up to 3000 psi.; 1546 Hose for fire resistant phosphate ester base systems up to 5000 psi.; 1532 Hose for fire resistant phosphate ester base systems up to 3000 psi. Write for full information; see our catalog pages in Sweet's Product Design File, Section 6d.

Aeroquip Flexible Hose Lines are easy to install, even in confined spaces as the hydraulic positioning table on this automatic partition assembler.

Using Aeroquip Bulk Hose and Reusable Fittings, hose lines of standard or varying lengths can be made up quickly by Huntingdon personnel.

On this hydraulic motor, Aeroquip Hose Lines give long dependable service. When replacement lines are needed, they can be made quickly.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

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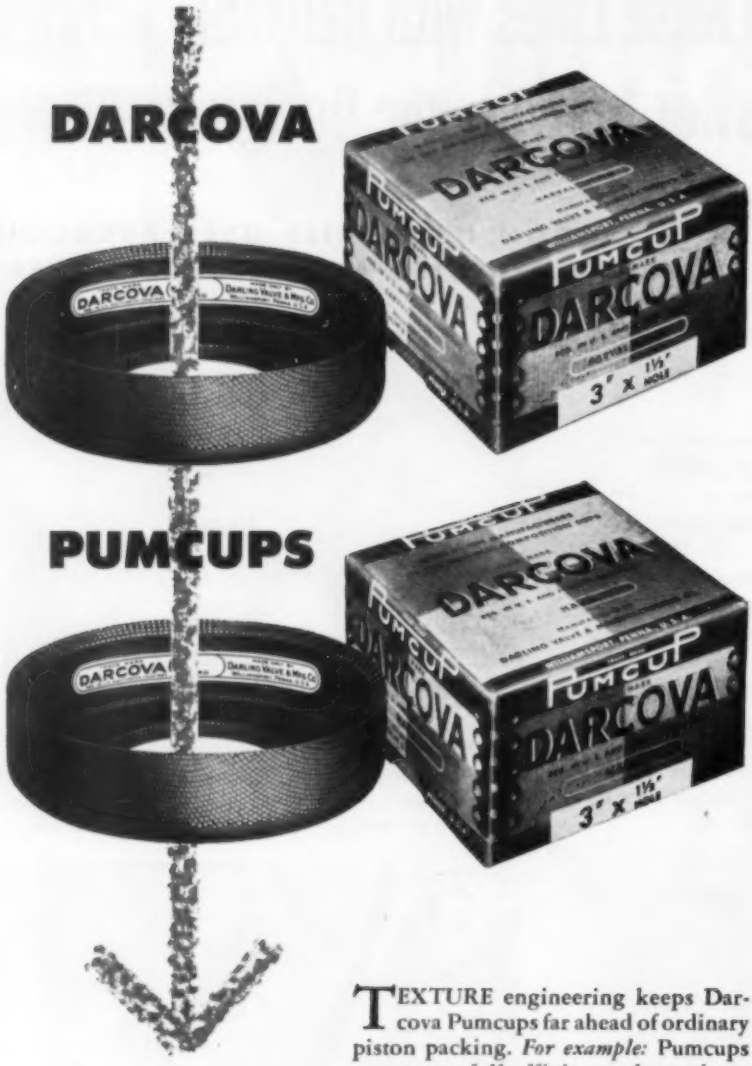


...famous for

- PUMPING EFFICIENCY
- LOWER COST
- LONGER SERVICE

TEXTURE engineering keeps Darcova Pumcups far ahead of ordinary piston packing. *For example:* Pumcups operate at full efficiency throughout their entire life. Fluid slippage is virtually eliminated.

Moreover, you can count on much longer service . . . users report Darcova Pumcups outlast other packing at least 3 to 1!

Write for all the facts on Darcova efficiency: Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms; No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

BRIEFS continued

Hydraulic Power Helps Construct St. Lawrence Seaway

Raising the 14,000 ton Jacques Cartier Bridge at Montreal calls for fine control and great lifting power—a "natural" for hydraulics. Tangyes of Canada Limited, subsidiary of Tangyes Limited, England, is furnishing the hydraulic equipment.

• **High lift**—Fourteen approach spans will be raised. The span above the shipping channel will be lifted about 60 feet, and the other 13 spans will be elevated as required to maintain the necessary gradiants.

• **Hydraulic units**—For this job, 18—500 ton units and 12—400 ton units of special type are required. They are capable of operating under a wide range of temperature conditions. Work must continue in winter although the temperature may be as low as —20 degrees F. Unit design includes mechanical means to hold the ram in any desired position when pressure in the cylinder is released. These units are also retracted by hydraulic pressure.

• **Application**—The 14 spans vary in length from 120 to 250 feet, and are supported at each end on concrete piers. These piers form the jacking points with 4 units positioned on each pier. These nests of 4 units of equal capacity operate from one motor driven pressure pump which has 4 equal, independent deliveries to operate each ram simultaneously.

Hand operated, lever control valves, grouped in pairs, control directional movement. Spans will

Continued on page 44

SIMPLIFY MACHINE DESIGN WITH THIS *Different* AIR CYLINDER

Save design time — save production costs. Eliminate cams, levers, gearing, linkages or other mechanical means for performing push, pull or lift motions. Design with air in mind.

The Bellows Air Motor is a complete electrically-controlled air cylinder power unit with directional valve and speed controls built in. It requires only one air connection which can be made with flexible hose. Compact, space saving, it fits well into crowded quarters or on moving machine elements. It is fast, responds to a starting impulse instantly. It is easily interlocked and synchronized with related machine movements. Its quality and reliability has been proven in more than quarter of a million installations.

The range of work it can do is limited only by the imagination of the design engineer.

Send for this free booklet

Here in these quick reading pages is the full story of The Bellows Air Motor — what it is doing for others, what it can do for you. Address Dept. AH-357 The Bellows Co., Akron 9, Ohio. Ask for Bulletin BM-25. In Canada, write Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

765-B

The Bellows Co.
AKRON 9, OHIO

Helicoid Gages

an ACCO product

Helicoid gages set new standards of enduring accuracy, trouble-free service, and economy

Acaloy Flanged Case

Acaloy Flangeless Case

Phenol Turret Case

Acaloy Flush Case

Acaloy Square Flush Case

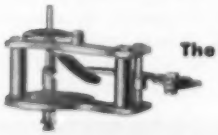
Industry has found in the HELICOID Gage, the most durable and efficient instrument ever devised to meet pressure-indicating requirements.

No Gears—No Teeth to Wear Out!
The exclusive HELICOID Movement is a simple, gearless cam-and-roller design with no teeth to wear out. It provides long and trouble-free service with a minimum of maintenance.

Sustained Accuracy—Longer Life
Because of advanced design, quality control in manufacture, and endless testing, HELICOID Gages produce more sensitive response to pressure changes. Their accuracy *endures*—even after millions of cycles.

Lowest Cost per Gage per year
These gearless gages go on performing day in and day out with little or no maintenance. This economy, together with long life, adds up to the fact that HELICOID Gages cost less per gage per year than any other gage you can buy.

Gages for vacuum and compound service. Pressure ranges up to 20,000 psi.



The Helicoid Movement

ACCO

Helicoid Gage Division
AMERICAN CHAIN & CABLE
929-H Connecticut Avenue • Bridgeport 2, Connecticut

for Better Valve

BRIEFS continued

be raised 6 inches at a time during the many lifting stages. At the end of each lift the bridge will be supported on concrete blocks while the rams retract for the next lift. At intervals of 2 feet of lift, concrete courses will be poured to surround the concrete blocks on the pier, and set into one integral slab. ▼▼▼

Hydraulic elevator pumping unit, featuring four hydraulic pumps for high capacity, was designed by Elevator Equipment & Supply Company. With a 15 hp motor operating at 1750 rpm, the unit will lift a passenger elevator at 65 fpm, or a 15,000 lb. loader freight elevator at 45 fpm. With a larger motor, the unit could handle 8500 lbs. at 70 fpm. Hydraulic oil reservoir and all pump mechanisms are completely enclosed. The four pumps are belt driven from the one motor.

Recent Publications

Machine Design: By Joseph E. Shigley. Published by McGraw Hill, New York. 523 pages; illustrated; Price $7.75.

In this book the subject is treated scientifically, and the author has shown the relationship between design specifications and the method of analysis used in solutions.

Part I gives a study of design of fundamental machine members, and develops basic design factors used in making engineering decisions. Part II applies these principles in the study of various de-

Continued on page 46

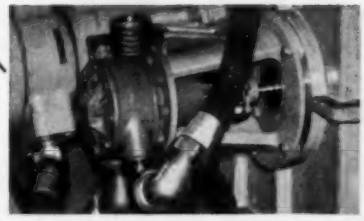
ANOTHER PUMP PROBLEM...SOLVED BY **TUTHILL**

Operates from -65° to 130° F

SUN ELECTRIC'S

Aircraft Hydraulic Systems Tester with

TUTHILL PUMPS



The Model AHT-30-A Sun Aircraft Hydraulic Systems Tester, shown here, has a tough assignment. Designed to simultaneously test in the field the hydraulic systems on two jet aircraft, without operating the aircraft engines, the tester must function under rugged operating conditions. For example, it must operate at temperatures from —65°F to 130°F...at altitudes from sea level to 6000 feet...at relative humidities from 95 to 100%.

These unusual operating conditions obviously dictate the choice of a special and unusual hydraulic fluid. The fluid finally selected met all requirements but had one drawback—it was tough on hydraulic pumps.

Like many others, Sun's engineers found the answer to their pump problem at Tuthill. A special modification of Tuthill's Model 4CB pump provided the backbone for the two separate hydraulic systems in Sun's Tester. The Tuthill pump is used to supply booster service by supercharging on the suction side of a standard high-pressure hydraulic pump. This combination allows the Sun Tester to deliver hydraulic fluid at the rate of 20 gpm at a pressure of 3000 psi through either or both of its two independent hydraulic systems.

Model CB, used in the Sun Tester, is a compact, dependable, self-priming, positive displacement pump with a special Tuthill mechanical shaft seal and built-in ball bearings, designed for directional operation. With an economical first cost, it requires negligible maintenance resulting in extremely low operating costs.

Model CB may provide the answer to your pump problem—or one of the other 750 models in the Tuthill line may supply your needs. If your requirements can not be met by one of our standard models, Tuthill engineers will work with you in developing a modification for your particular application.

If you have a pump problem, your Tuthill representative probably has the answer. Why not call him today?

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois
Gentlemen:
☐ Please send me information on the Model C Series
☐ Please send information on the complete Tuthill line.

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Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities from 1 to 200 GPM, for Pressures to 600 PSI, Speeds to 3600 RPM.

TUTHILL PUMP COMPANY

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Canadian Affiliate:
Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

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achieved through design

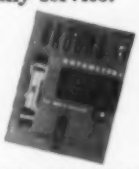
ROTAMETERS

a FULL LINE
for every service

Whatever your flow measurement or remote transmission needs . . . Brooks has the answer. Moreover, it is a *practical* answer . . . because the same practical design features are carried through the line. From Hi-Accuracy Flow Indicators to low-cost purge meters . . . from the well-known Ar-Met Armoured Meter to the new convertible electric or pneumatic flow transmitters, you'll find these common features: self-alignment of essential parts, simplified cleaning and assembly, and designs that eliminate troublesome line strain on the metering elements.

You can depend on Brooks rotameter equipment for *lowest final cost* all down the line—because it has been performance-proven where it counts most: in daily service.

Send for your copy of Bulletin 110b, a brief, well illustrated guide to Brooks Rotameters and Accessory Equipment.



BROOKS ROTAMETER COMPANY
357 L Street, Lansdale, Pa.

the new standard of
flow measurement
and control

BRIEFS continued

sign approaches to a group of common machine elements.

One of the machine elements covered is hydraulic machines. Among the first decisions the designer must make is the method of transmitting power. In many cases the use of hydraulic machines offers advantages over other methods of power transmission. Characteristics of hydraulic power are listed and basic elements are discussed. Pumps, fluid motors, cylinders, piping and controls are covered, and several sketches of hydraulic circuits are given. ▼▼▼

Air Operated Rod Straightening Machine

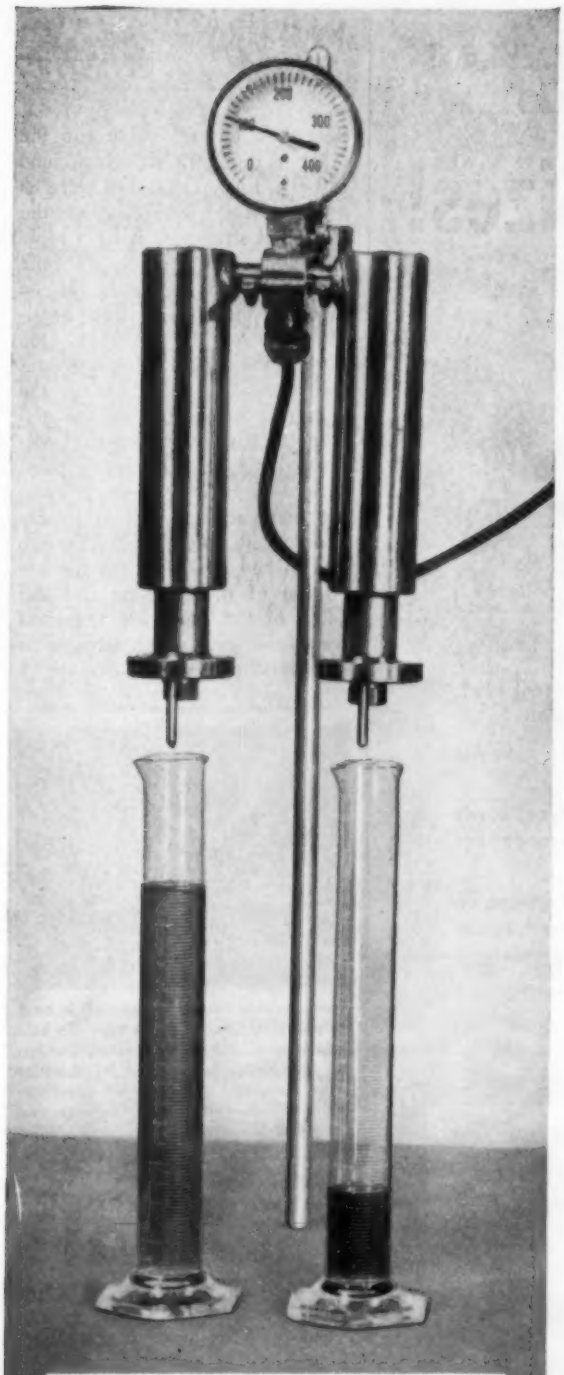
• **Increased Savings**—Foundry operators can use the same core rods and gaggers several times by means of a core rod straightener and shear machine manufactured by Wheelabrator Corporation. Besides making it possible to get maximum service out of a supply

of steel rods, the machine greatly reduces labor requirements for reclaiming them.

• **Air at 90 psi**—The machine will operate as fast as material can be fed into it. Two heavy alloy

Continued on page 48

Feature of this mobile crane designed by British Hoist & Crane Company Ltd., England, is the use of a telescoping boom. It permits the handling of loads inside covered vehicles with the chassis stationary. Hydraulic power is used for slewing, telescoping and raising the boom. The unit can lift loads up to two tons and pass under doors nine feet high and operate under ceilings of ten feet.



Less oil loss with Suntac is proved by this leakage demonstrator. Suntac oil is placed in one chamber, a straight mineral oil of the same viscosity in the other. Both oils are pressured through sintered bronze bearings. At 100 psi the straight mineral oil leaks out four times faster than Suntac.

LEAKAGE DEMONSTRATOR PROVES SUNTAC CAN CUT OIL LOSS AS MUCH AS 75%

Expensive equipment overhauls to stop leaks in hydraulic systems can often be avoided by a change to Suntac®. The exceptional antileak characteristics of Suntac oils can reduce oil losses as much as 75%, as can be proved in the leakage demonstrator. *Some users have reported actual drops in oil leakage of 90%.*

Suntac oils give you lower lubrication costs, cleaner equipment and floors, safer working conditions. Their leak-reducing agent leaves no gummy film or residue. In addition, Suntac oils are fortified against oxidation to lengthen oil life...against rust and corrosion to lengthen equipment life.

You'll find Suntac a money and time saver in your hydraulic systems...and a high-quality general-purpose oil for many other uses.

WANT MORE SUNTAC FACTS? Ask your Sun representative for Technical Bulletin 23. Or you can get full details, prices, and delivery information by writing to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. **AH-8.**

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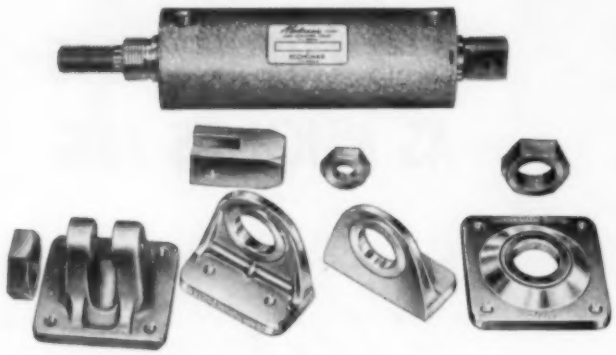

TWO NEW BORE SIZES—1 ½" and 4" now added to present 1 ⅛", 2" and 3" bores; for air or hydraulic service to 200 p.s.i.

COMPACT—internal feed-ring locking of heads to cylinder barrels eliminates bulky head castings.

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NON-CORROSIVE CONSTRUCTION—barrels of seamless hard-drawn brass tubing, rods of ground and polished stainless steel, heads and piston of aluminum—with reliable, job-proved industrial "O" ring sealing throughout.

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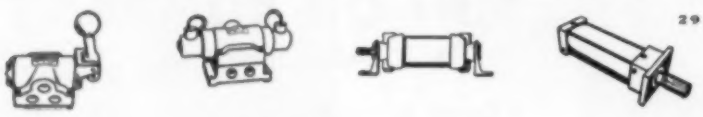


29

BRIEFS continued

steel dies, one moveable and the other stationary, straighten one rod at a time. These dies close as a contracting square upon the work and straighten it by a blow delivered simultaneously on four sides. Big kinks in rods can be quickly removed first in the bending jaws of the machine. One blow of the straightening dies does the rest. After straightening, the rods can be sheared on the machine to the desired length. Compressed air at a minimum pressure of 90 psi will efficiently operate the machine. Unit is rigidly constructed to withstand severe strains and stresses. Both the operation of the machine and the force of the blow are regulated by a hand lever which actuates an air throttling valve. ▼▼▼

Fuel manifold tubing for aircraft is bent to shape in fixtures of this type. To hold tolerance of .015 inch diameter, seamless Inconel tubing is supplied by Superior Tube Company to meet rigid specifications on diameter, wall thickness and chemical properties.

Air-Operated Clutches and Brakes

A press clutch controller provides facilities for continuous and single-stroking and inching. The Pneumatics Division of Baldwin Instrument Co. Ltd., designed this unit to provide a versatile and functionally reliable control for air-operated clutches and brakes used on intermittently reciprocating machines, such as crank presses, press brakes, roll forging machines, and shears.

• **Continuous stroking**—On operating the start button, a sole-

Continued on page 50

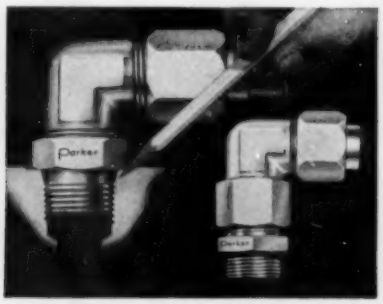
Be sure to see Parker for both tube and hose fittings!

Here, from one convenient source, you can get the most advanced hydraulic fittings available . . . both tube *and* hose. For example, new Parker *no-skive* Hoze-lok fittings require no stripping of rubber-covered hydraulic hose. They're faster, easier to use and *re-usable.*

Also, new Parker *straight-thread* tube fittings solve high-pressure hydraulic leakage problems resulting from tapered pipe threads. *Straight* threads are available on Triple-lok (the industrial standard flare tube fitting) and on Ferulok (flareless fitting for heavy steel tubing).

Parker
Hydraulic and fluid system components

No-skive Hoze-lok fittings need no stripping of hose covers. Only two simple steps complete the make-up. Re-usable.



Straight-thread tube fittings provide leakproof, trouble-free connections. No overtightening. O-ring makes the seal.

TUBE & HOSE FITTINGS DIVISION
Section 422-A
The Parker Appliance Co.
17325 Euclid Ave., Cleveland 12, Ohio

- ☐ Please send *no-skive Hoze-lok* Catalog No. 4433
- ☐ *Triple-lok* Catalog No. 4310
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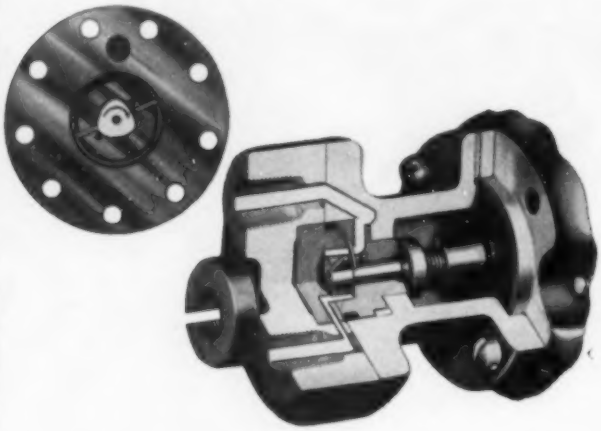
Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

Compact • Light Weight

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

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BRIEFS continued

noid valve is energized. This exhausts the air-operated brake and applies air via a restrictor valve to the clutch. This restrictor valve is necessary to be sure the brake is off before the clutch is engaged.

Press commences continuous operation and continues until the stop button is depressed. Press will complete its stroke and come to rest at top dead-center. A cam-operated electrical switch disconnects the supply to the solenoid

valve when the press stops. When the valve is de-energized, the clutch is connected to exhaust and air is applied to the brake via the restrictor valve. This assures drive being disconnected from the press before the brake is applied.

An emergency stop switch will stop the press no matter what mode of operation is used. Press will remain inoperative until the reset button is depressed.

• **Single stroking**—Start button is operated, and after completing one stroke and reaching top dead-center, press stops automatically. This is effected by the cam-operated switch.

• **Inching**—Press continues to move with start button depressed and stops when button is released. Press stops at top dead-center even if start button is held down. Button must be released momentarily to produce further movement.

▼▼▼

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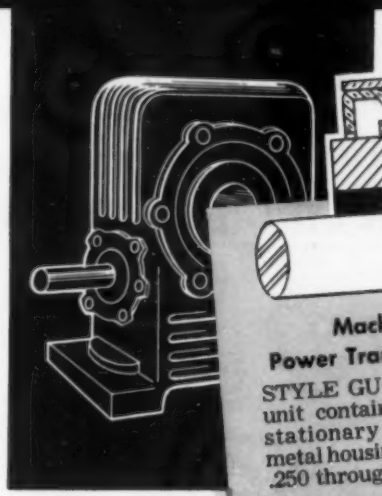
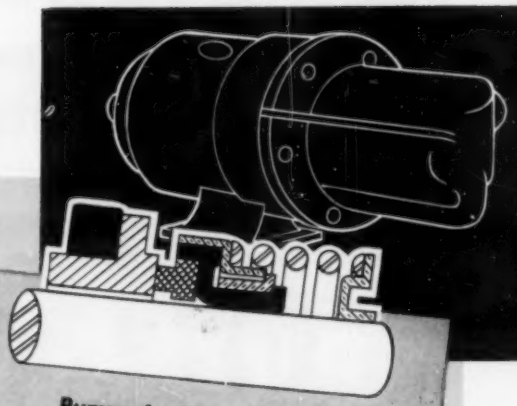
Circle 65 →



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



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ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

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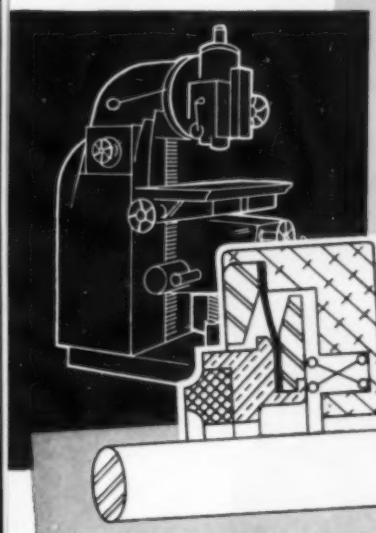

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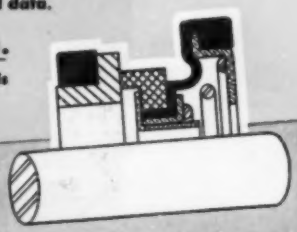
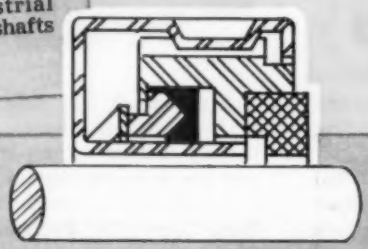


Household Appliances

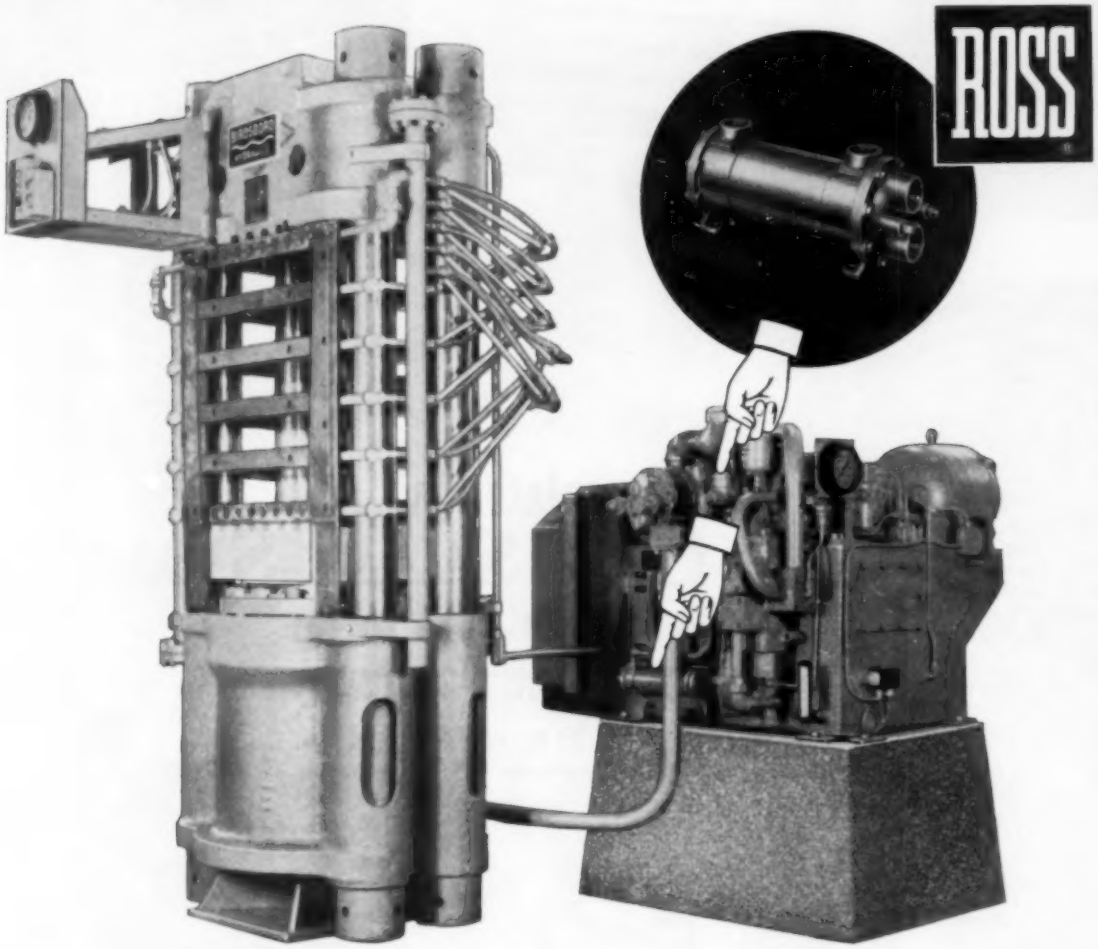
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.

Squeezing out grinding wheels by the dozens this Birdsboro Press relies on a ROSS EXCHANGER for constant oil temperature



Exerting up to 600 tons of pressure, this Birdsboro hydraulic press turns out approximately 45 grinding wheels during one curing period.

A Ross Type BCF Exchanger keeps the hydraulic oil from over-heating and thinning, even under sustained pressures. Power losses are prevented, carbon deposits in the pump eliminated, and peak performance assured *at all times.*

Ruggedly built to withstand punishing hydraulic shock, Ross Exchangers are unsurpassed for heat transfer efficiency. That's why they are regularly installed to safeguard performance of numerous types and makes of hydraulic equipment: extrusion and metal drawing presses, stretch-wrap formers, die-casting machines, powdered metal presses, injection and compression molding machines.

Completely pre-engineered and fully standardized, Ross Type BCF Exchangers are available in a wide range of sizes to meet your heat transfer requirements.

Learn more about the efficiency of Ross Exchangers by requesting Bulletin 1.1K5. Write: Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

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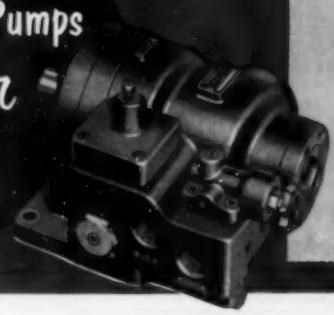

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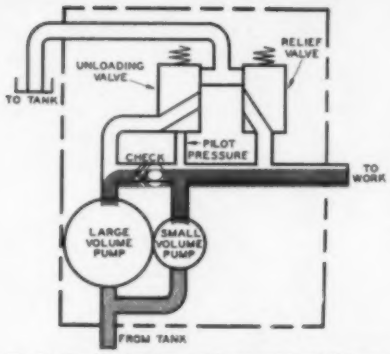

Fig. 1 Combined Delivery of Large and Small Volume Cartridges at Low Pressure

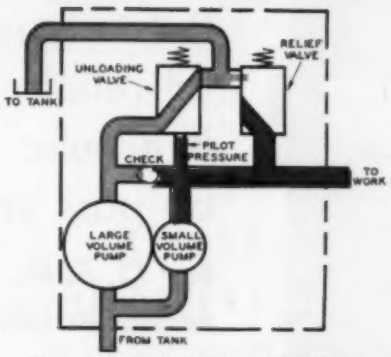

Fig. 2 Delivering Small Volume at High Pressure

Two Vickers Vane Type pumping cartridges are mounted on the same shaft—in the same housing, driven by the same prime mover. One provides a large volume of oil while the other delivers a small volume. These Vickers Two-Pressure Pumps have proved advantageous in a wide variety of applications.

For example, in closing a press or in rapid advance, both pump cartridges work together, supplying maximum volume for quick operation (see Fig. 1). When the press is closed and compression begins, or when the tool goes into feed immediately prior to beginning the cut, the large volume cartridge is automatically unloaded to the reservoir at zero pressure (see Fig. 2). The small volume cartridge alone then provides the lower volume required at high pressure.

These Vickers Two-Pressure Pumps are most economical in power consumption for such two-pressure operation. The reason for this is that a small-volume pump working at full capacity is MORE EFFICIENT than a large-volume pump working at partial capacity. Regardless of momentary delivery, the internal leakage of any pump is proportional to its size and operating pressure. The chart (Fig. 3) shows an interesting comparison between a Vickers Two-Pressure (Two-Volume) Pump and a variable volume vane type pump on a press circuit.

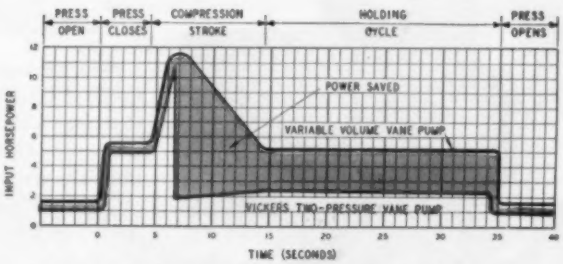

Fig. 3. On this typical press application the saving in power is approximately 50% with a resultant saving in heat in the system.

Like all Vickers Vane Pumps, these two-pressure pumps have the hydraulic balance feature that relieves bearings of all pressure loads (one of the major causes of wear). Cartridge construction enables customer to service in his own plant instead of returning to factory should repairs be necessary. Relief and unloading valves are integral . . . minimizing piping and connections. Complete range of sizes up to 48 gpm. For additional information, ask for Bulletin 54-70a.

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Future Events

March 13-15: Spring Meeting National Fluid Power Association. Hollywood Beach Hotel, Hollywood-by-the-Sea, Florida. For information contact Barrett Rogers, Executive Secretary, 1618 Orrington Avenue, Evanston, Ill.

March 20-22: SAE Production Meeting and Forum, Hotel Statler, Buffalo, N. Y.

March 25-27: American Society of Tool Engineers Silver Anniversary Technical Meeting and Convention. Shamrock Hilton Hotel, Houston, Texas. Program Director is L. S. Fletcher, 10700 Puritan Avenue, Detroit 38, Mich.

March 25-29: 10th Western Metal Congress and Exposition. Congress will be held at Ambassador Hotel, exposition at Pan-Pacific Auditorium, Los Angeles, Calif.

April 2-5: SAE Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display, Hotel Commodore, New York, N. Y.

April 8-12: Annual National Spring Meeting of the American Welding Society. Hotel Sheraton, Philadelphia. For information write Robert T. Kenworthy, Exposition Management 12 East 41 St., New York 17, N. Y.

April 29-May 3: National Materials Handling Exposition, and 7th National Materials Handling Conference of the American Material Handling Society, Convention Hall, Philadelphia, Pa.

May 8-11: Spring Meeting of The Fluid Control Institute, Inc. Greenbrier Hotel, White Sulphur Springs, W. Va.

June 9-14: Third Annual Automation Seminar, Pennsylvania State University, University Park, Pa. For complete information and registration contact Chester Linsky, assistant professor of industrial engineering.

October 17-18: The 13th Annual Conference on Industrial Hydraulics. Hotel Sherman, Chicago, Illinois. Raymond D. Meade is Conference Secretary. ▼▼▼

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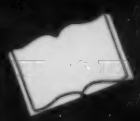

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Designed for the cotton industry, this new hydraulic press permits an operational economy which has been called “one of the most important moves in the industry since Eli Whitney invented the cotton gin.”

This press produces high density bales at the cotton gin, eliminating the need for extra compression of standard density bales before export shipment. Cotton bales from this press measure only 21″ x 23″ x 54″.

The first cotton baling press of its size, it operates at a hydraulic pressure of 2,000 psi, and exerts a total force of 1,650,000 pounds. Both of its main hydraulic cylinders were made from 23″ OD Acipco steel tubes.

Because they are centrifugally spun, Acipco steel tubes possess a uniform, highly dense, non-directional grain structure which is easier to machine, yet stronger and tougher. This quality, and others, can mean important economies in your application — both for you, and for your customer. Find out how by calling or writing your nearest Acipco distributor today.

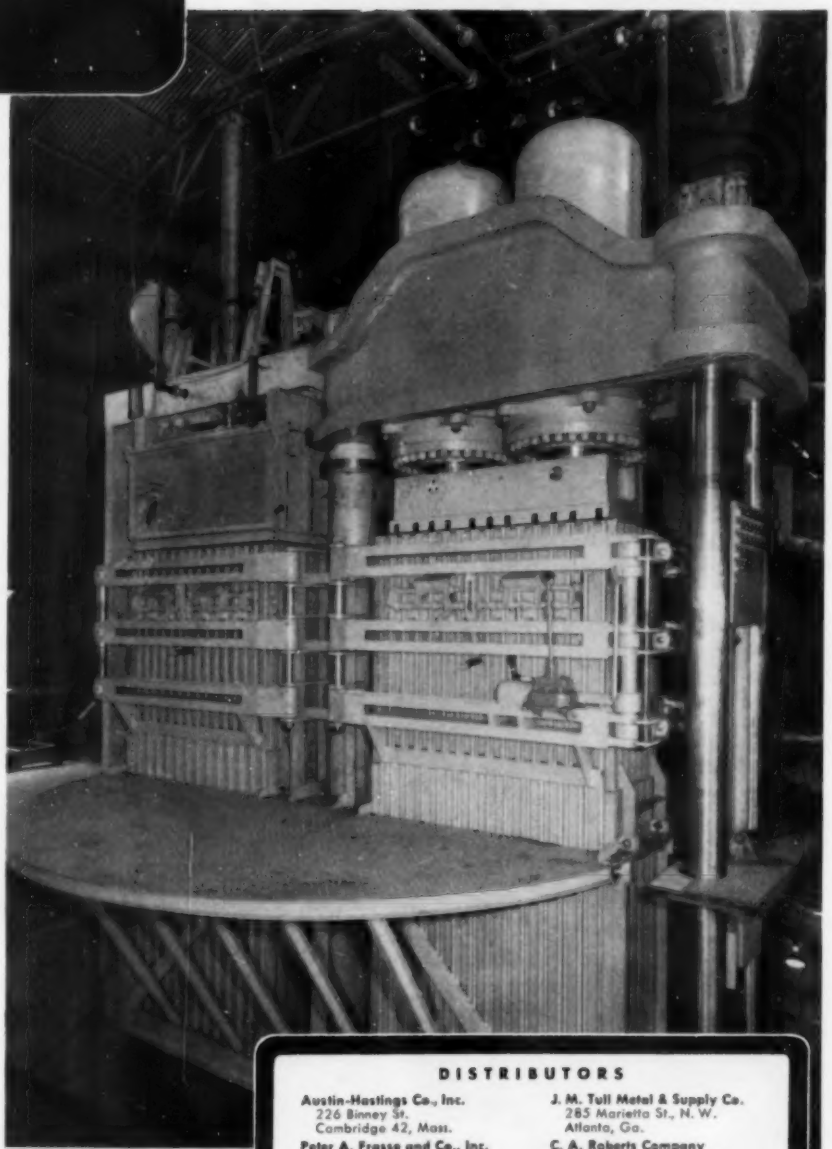
SIZE RANGE: Lengths up to 16′ — longer lengths by welding tubes together. OD's from 2.25″ to 50″; wall thicknesses from .25″ to 4″.

ANALYSES: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steels; plain carbon grades and special non-standard analyses.

Versatile ACIPCO

CENTRIFUGALLY SPUN Steel Tubes

“Delta” High Density Press, manufactured by Continental Gin Company of Birmingham, Ala. for a California cotton gin. Photo courtesy Continental Gin Company.



DISTRIBUTORS

Austin-Hastings Co., Inc.
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Peter A. Frasse and Co., Inc.
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New York 13, N. Y.

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Montreal 3, Canada

Vinson Steel & Aluminum Co.
4606 Singleton Blvd.
Dallas 7, Texas

J. M. Tull Metal & Supply Co.
285 Marietta St., N. W.
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C. A. Roberts Company
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AMERICAN CAST IRON PIPE CO.
ACIPCO
Special Products Division
BIRMINGHAM 2, ALABAMA

it gives—
and it takes

The seal is synthetic rubber-impregnated fabric, bonded with a pliable, resilient synthetic rubber filling. This combination will stand up to severe punishment and is impervious to the action of hydraulic fluids. The even flow of the filling ensures no down-or-seal-wear from fluid pressure distortion.

the higher the pressure—
the better the seal

The on the pressure — Hallprene — will press it and create a seal even if the fluid pressure falls to zero.

NOTHING

GETS PAST

Hallprene

BRITISH PATENT NO. 774,017
CANADIAN PATENT NO. 537,[illegible]

Pressure-proof — drip-proof — seep-proof — oil-proof — *NOTHING* can squeeze past Hallprene Patent Fluid Seals. Built to take high pressure punishment, Hallprene seals are tough—EXTRA tough. For POSITIVE and PERMANENT sealing.

Hallprene

the seals that pressure can't lick

FOR FULL DETAILS WRITE TO

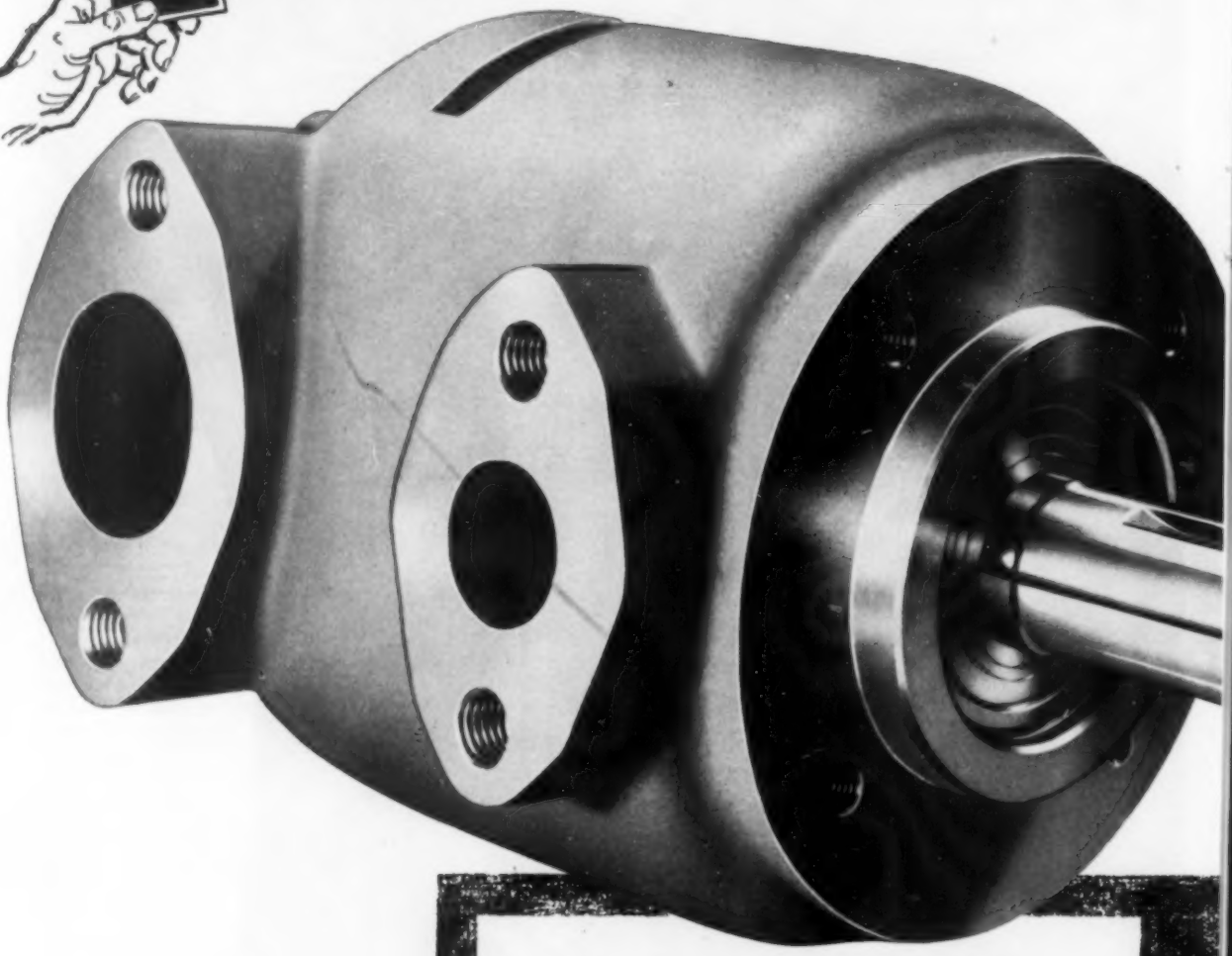
HALL & HALL LTD

OLDFIELD WORKS HAMPTON MIDDLESEX ENGLAND

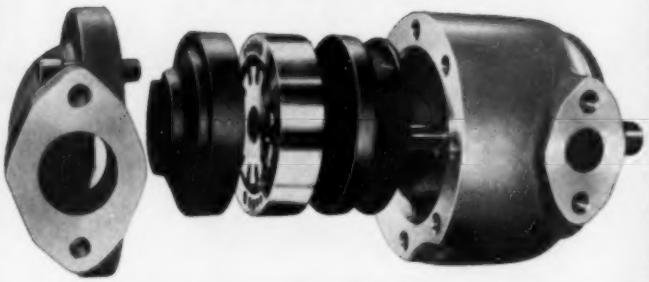
Tel: Molesey 2188 (8 lines)

P4309

FROM DENISON



For mobile equipment
For special machinery
For automation



Denison's exclusive cartridge construction. *Side plates hydraulically loaded to maintain uniform pressure on rotor regardless of delivery pressure.*

Continuous 2000 psi service in a versatile vane-type hydraulic pump

FOR MOBILE EQUIPMENT, less weight, increased payload

FOR SPECIAL MACHINERY, more power in less space

FOR AUTOMATION, heavy-duty design for low maintenance

● Here are the important features you can engineer into your designs with Denison's new "T" Series balanced vane hydraulic pump.

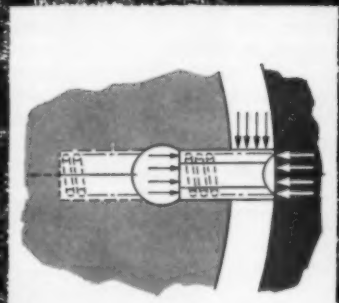
Long, efficient life because Denison's fully-balanced vanes and rotors reduce wear on cam rings and thrust plates to give long pump life with minimum maintenance.

Packs More Power in Less Space. Internal friction is lower, volumetric efficiency is higher. Actually packs 50 h. p. in less space than a conventional 3 h. p. electric motor where space and weight are a premium.

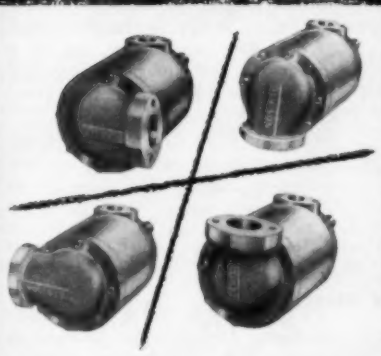
Cold-Weather Starting, under severe weather conditions, to maintain construction schedules.

Fast, Easy On-the-Job Service because the complete pumping cartridge can be removed and replaced as a unit without special tools or skills.

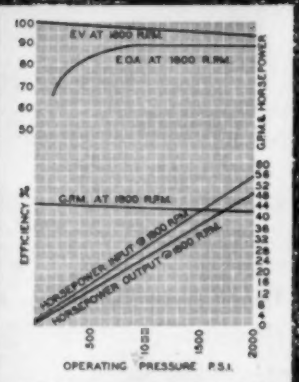
Write for complete engineering specifications in Bulletin 200. Denison Engineering Division, American Brake Shoe Co., 1166 Dublin Road, Columbus 16, Ohio.



***Hydraulically balanced vane construction** cuts excessive wear on vane and cam ring . . . for longer life, higher volumetric efficiency.*



***Universal Mountings** . . . may be mounted in any of four different positions—face, flange or bracket mounted. Operates clockwise or counter-clockwise.*



Performance curve of "T Series" vane-type pump illustrates high volumetric efficiency.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

HYDRAULIC PUMP . . . for 5000 psi service

Features: Micronic filter provides 100 percent filtration of fluid before entry to high pressure, axial piston end. Complete range of mountings available. Axial rolling pistons are one-piece, alloy steel with balanced-port valves.
Specifications: Constant displacement pump is designed for heavy duty, continuous 3000 to 5000 psi operations at 3 to 10 hp. Capacities at 3000 psi range from 233 to 1090 cipm (1 to 5 gpm), depending on size and rpm of driving motor.
Applications: Suitable for use on die casting machines, large injection molding presses, double-acting or 4-way differential presses, calendar hold-downs and similar equipment. Unit can support high static loads over long periods under adverse conditions.

The Oilgear Company
Milwaukee, Wis.
Circle 190 on Reader Service Card

OIL FLOW DIVIDER . . . has 10-95 percent range

Application: Hydraulic engineers with problems involving division of flow for two or more operations will be interested in this unit. When pressure of the primary operation begins to build up, flow to the secondary operation begins to decrease. This means that on a fork truck, for instance, no power in lifting will be sacrificed to power steering.
Features: Flow divider can be adjusted with an ordinary screw driver to control flow over 10 to 95 percent range. Built-in relief valve passes oil back to the sump when peak pressure of secondary flow is reached. Unit permits two simultaneous operations from one pump. It operates on low circulation pressure from the pump and divides the flow in any desired proportion. Unaffected by temperature, its simple, compact design and quiet, smooth operation make installation and service easy, and free the system from noise.

New Products Corporation
Skokie, Ill.
Circle 191 on Reader Service Card

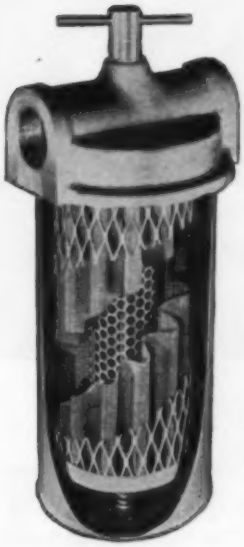
VALVE MANIFOLD . . . speeds assembly

Features: Unit can be adapted to any type of control valve application. Combinations of single or double-solenoid valves can be mounted at any station on the manifold. 2, 3, and 4-way valves can be used in any combination. Remote-operated, speed-controlled, and oil pilot valves can also be installed. For uniformly mounting 2 to 6 or more valves, manifolds can be ganged by bolting the assemblies together end-to-end. O-rings seal inlet, outlet and wiring ports. NPT threading of ports simplifies connection to supply and plugging of terminal ends.
Specifications: Available in 2 and 3 station types, with side or bottom cylinder porting to facilitate piping. Cylinder ports are ⅜ or ½-inch NPT.

Valvair Corporation
Akron, Ohio
Circle 192 on Reader Service Card
Continued on page 63

Here's What Users Have to Say About
MARVEL Synclinal FILTERS

SUMP TYPE
(cutaway)



LINE TYPE
(cutaway)

U. S. STEEL CO., Irvin Works Three-Stand Cold Reduction Mill—

"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines".

JONES & LAUGHLIN STEEL CORP., Aliquippa Works—

"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size".

P. R. MALLORY PLASTICS, INC. Supt. of Maintenance Leo Paszkiet reports—

"We have one injection molding press here that was giving me a lot of trouble. In order to maintain our 24-hour-a-day schedule, I had to stop it every two or three weeks to service the filters. It was a troublesome, time consuming job but it had to be done. Even then, the machine never seemed to reach the productive capacity I knew it was capable of. Well, I had enough of that so I pulled out the original 3 filters and replaced them with three 50 G.P.M. Sump type, Marvel Synclinal Filters. That was over 10 months ago. During all this time the machine was operating faster and smoother than it ever had before. There was no more slow down of production due to pressure loss, vibration, pump starvation, etc. On the basis of these results, we are installing Marvels on every hydraulic machine in our plant, except of course, those on which Marvel Synclinal Filters were installed as standard equipment by the manufacturer".

Many others reporting similar results are now specifying MARVEL SYNCLINAL FILTERS on all new hydraulic equipment—and Standardizing with MARVEL SYNCLINAL FILTERS on all existing equipment.

For Dependable Protection on All Hydraulic and Other Low Pressure Circulating Systems— Investigate MARVEL SYNCLINAL FILTERS

They Meet J. I. C. Standards

FILTERS FOR ALL TYPES OF FIRE-RESISTANT FLUIDS

Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant fluids.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced, synclinal design.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

OVER 750 Original Equipment Manufacturers Now Install MARVEL SYNCLINAL FILTERS as Standard Equipment!

IMMEDIATE DELIVERY!

Our catalogs contain complete engineering data and dimensional charts of all models and sizes. You can order a filter to meet your specific requirements and get IMMEDIATE DELIVERY.

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-3)

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name _____ Title _____

Company _____

Address _____

City _____ State _____

VISION

IT'S a little like the chicken and the egg, this matter of vision and leadership. Each complements the other. At least that is the case with The Weatherhead Company. For instance, back in the middle thirties, it took not only inborn leadership but also keen foresight to visualize the importance to industry of the now famous Weatherhead Ermeto flareless tube fitting.

Today, wherever the function is motivated by hydraulic power, Weatherhead Ermeto is industry's first choice. The Ermeto story is typical of many Weatherhead products which continue to play important roles in our country's phenomenal industrial achievements.

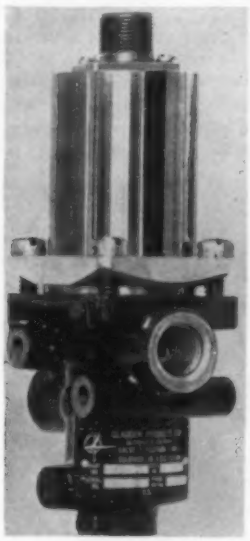
WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

THE WEATHERHEAD CO., FORT WAYNE DIVISION
Dept. A-3, 128 West Washington Blvd., Fort Wayne, Indiana
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

New Products continued

HYDRAULIC SELECTOR
. . . features high speed operation

Features: Solenoid operated, 3-way, 2-position valve offers very high speed of operation with continuous duty. Unit is lightweight, with no moving seals and has very low leakage. Designed to permit any 3-way plumbing connections and operation, normally open or closed, with an operating pressure of 3000 psi and a flow of 3 gpm at 55 psi pressure drop. Solenoid operates at



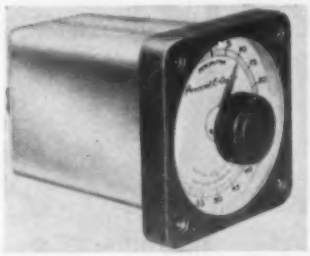
18-30 volts DC, 24 ohms, and permits very high speed of operation suitable for aircraft anti-skid or other automatic control applications. Solenoid is dry, impregnated, with a potted coil, and is completely separated from working fluid. Valve is ⅜-inch tube size and uses corrosion resistant materials and finishes.

Gladden Products Corporation
Glendale, Calif.

Circle 193 on Reader Service Card

CYCLE TIMER
. . . saves fluid power

Designation: Percent-O-Cycle
Specifications: Timer closes a contact for an adjustable interval in a fixed time cycle with repeat accuracies less than 1/10 percent. Standard time cycles are from 15 seconds to 8 hours. Unit measures 3⅜ x 3⅜ x 5¾ inches.
Features: Unit is a highly accurate, attractive and compact package which eliminates waste of power on filters, pumps, and other fluid



power components. It is used as an alternate for rheostats and other variable voltage equipment. Without auxiliary equipment, loads up to 25 amps at 150 volts, 60-cycle, may be handled.

Hagen Manufacturing Company
Moline, Ill.

Circle 194 on Reader Service Card

AIR VALVE
. . . controls at 1000 F

Designation: MV36R
Features: Pneumatic solenoid valve controls air temperatures to 1000 F and air pressure to 4000 psi for flight or test stand applications. Final temperature rating is not yet established, but over 50 tests were made with line fluid temperatures

between 700 and 1000 F. Under test, valve is normally closed. Flow characteristics are similar to those of an elbow fitting of the same size. Actuation time is less than .050 second, and internal leakage

Continued on next page

WEATHERHEAD

ONLY COMPLETE SINGLE SOURCE FOR HYDRAULIC HOSE LINES AND FITTINGS

STEEL TUBE FITTINGS
Ermeto® Flareless and
Flare-Twin S.A.E. 37° Flared

BRASS TUBE FITTINGS
S.A.E. 45° Flared • Inverted Flared • Pipe • Compression • Selfalign® • Threaded Sleeve • Drain and Shutoff Cocks

HYDRAULIC HOSE, ENDS, ASSEMBLIES
Bulk Hose • Reusable Hose Ends
Crimped and Swaged Hose Assemblies

PUSH—PULL CONTROLS

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Fort Wayne, Indiana

ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

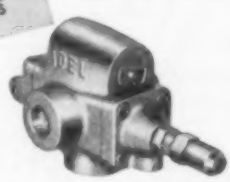
GEAR-TYPE HYDRAULIC PUMPS

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

Reliability

ADEL PRECISION PRODUCTS

A DIVISION OF GENERAL METALS CORPORATION

BURBANK, CALIFORNIA • HUNTINGTON, WEST VIRGINIA

Manufacturers of MARINE & INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT

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UTAH •
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Salt Lake City 10, Utah

WASHINGTON •
Haskel Engineering & Supply Co.
Seattle, Washington

New Products / continued

is negligible. Valve can also be made for liquid oxygen and high temperature hydraulic applications. **Specifications:** Available in sizes from ¼ to 2 inches and ½ inch AND tube size. Voltage is 24 DC.

Marotta Valve Corporation
Boonton, N. J.

Circle 195 on Reader Service Card

AIR TRAP
. . . has system-power action

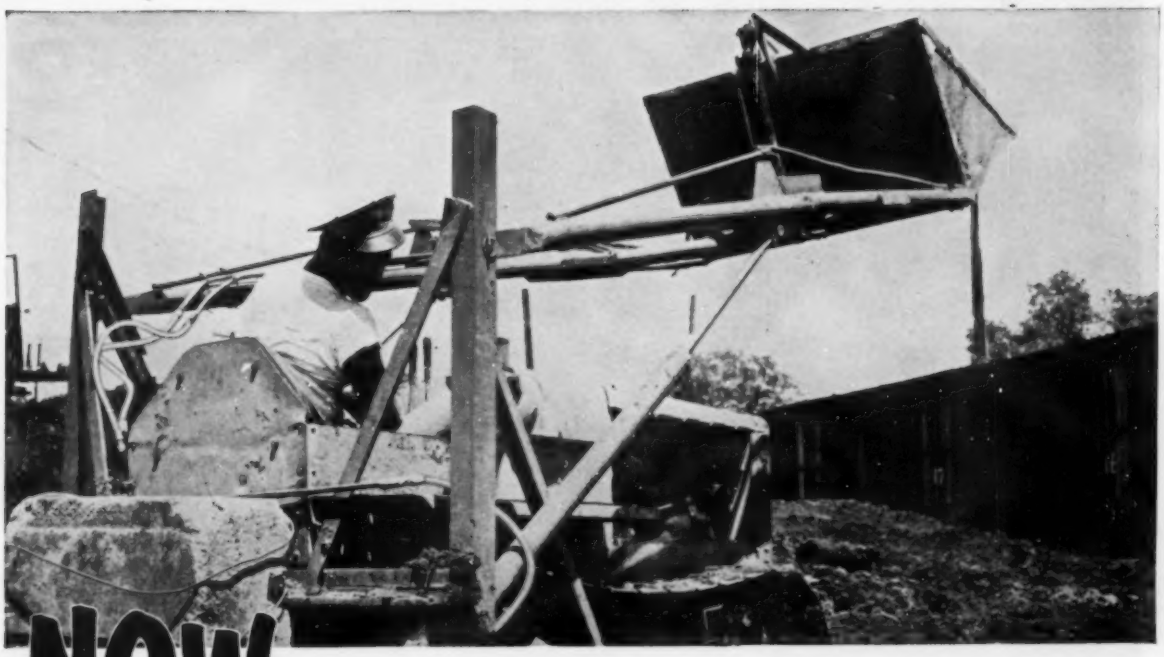
Designation: Mag-Pneu-Power
Operation: Trap discharges condensate from compressed air lines by a combination of magnetic, pneumatic and automatic action. As condensate rises in the trap, the float does not rise, but is held firmly in place by the magnet mounted on the pivot arm. When force build-up of the condensate

overcomes the magnetic attraction, the float snaps open the pilot valve. Air enters the pilot valve, flows down the stem and up under the piston, forcing the piston assembly upward, which opens the main discharge valve. System pressure forces the condensate into the discharge outlet. Piston mechanism is completely sealed off to prevent damage or clogging. Pressure range of the trap is from 10 to 200 psi.

Hankison Corporation
Pittsburgh, Pa.

Circle 196 on Reader Service Card

For more NEW PRODUCT reviews turn to page 136



NOW •• the right hydraulic hose assembly for every need

For the first time a world-known *hose manufacturer* offers a correct hydraulic hose assembly for every industrial need . . . bulldozers, concrete mixers, dump trucks, farm machinery, grease racks, power shovels.

This means you can get quickly, correct lengths of highest quality Gates Hydraulic Hose ready-fitted with exactly the permanent or re-usable couplings you want.

Over-all quality control and a nation-wide service organization put Gates in a *unique* position to assist manufacturers of machines, vehicles and implements with hydraulic system applications.

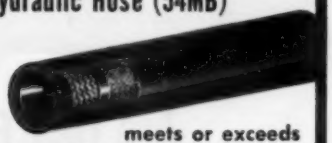
GATES Distributors are in the Yellow Pages

Consult the yellow pages of your phone book for your nearest Gates Engineering Office.

The Gates Rubber Co., Denver, Colorado

The Mark of Gates Specialized Research

Gates High Pressure Hydraulic Hose (54MB)



meets or exceeds SAE specifications

This smooth-covered, easy-to-keep-clean hose has reinforcing braid of extremely flexible high-tensile wire, made expressly for this use. Black, oil-resistant rubber withstands heat, abrasion and weather exposure. Recommended for systems subjected to shock loads and heavy pulsating pressures.

Gates Medium Pressure Hydraulic Hose (19HB)

Same quality construction, but with braided cord reinforcement — ample for the lower pressure applications.

Gates Hydraulic Hoses

TPA 192

Are your Oil Seals burning up?

Oil seal failure often results from excessive heat . . . caused by friction plus high operating temperatures. New hi-temperature applications for both lubricating and Type-A transmission oils are putting the heat on seal manufacturers.

That's why IPC has custom compounded new BUNA-N seal materials especially for hi-temperature use. In many instances, IPC's BUNA-N Oil Seals are ideal for operating temperatures up to 325° F.

Naturally your specific application is the deciding factor. If you're interested in lower-cost oil seals for temperatures up to 325° F. be sure to check your specifications with IPC . . . the foremost custom compounders of packings — oil seals — precision molding.

BONDED BY IPC

1. Bonded Washer Seal Double Lip Wiper
9. Bonded Case Seal Straight Lip With Garter Spring
2. Bonded Case Seal Double Lip Wiper
10. Bonded Case Seal Limited Contact Lip With Garter Spring
3. Bonded Washer Seal Straight Lip
11. Bonded Case Seal Straight Lip Thin Rind Type
4. Bonded Washer Seal Limited Contact Lip
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
5. Bonded Washer Seal Straight Lip With Garter Spring
13. Rubber Covered Bonded Case Seal Straight Lip
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
14. Rubber Covered Bonded Case Seal Limited Contact Lip
7. Bonded Case Seal Straight Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
8. Bonded Case Seal Limited Contact Lip
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

PACKINGS • OIL SEALS • PRECISION MOLDING

P2

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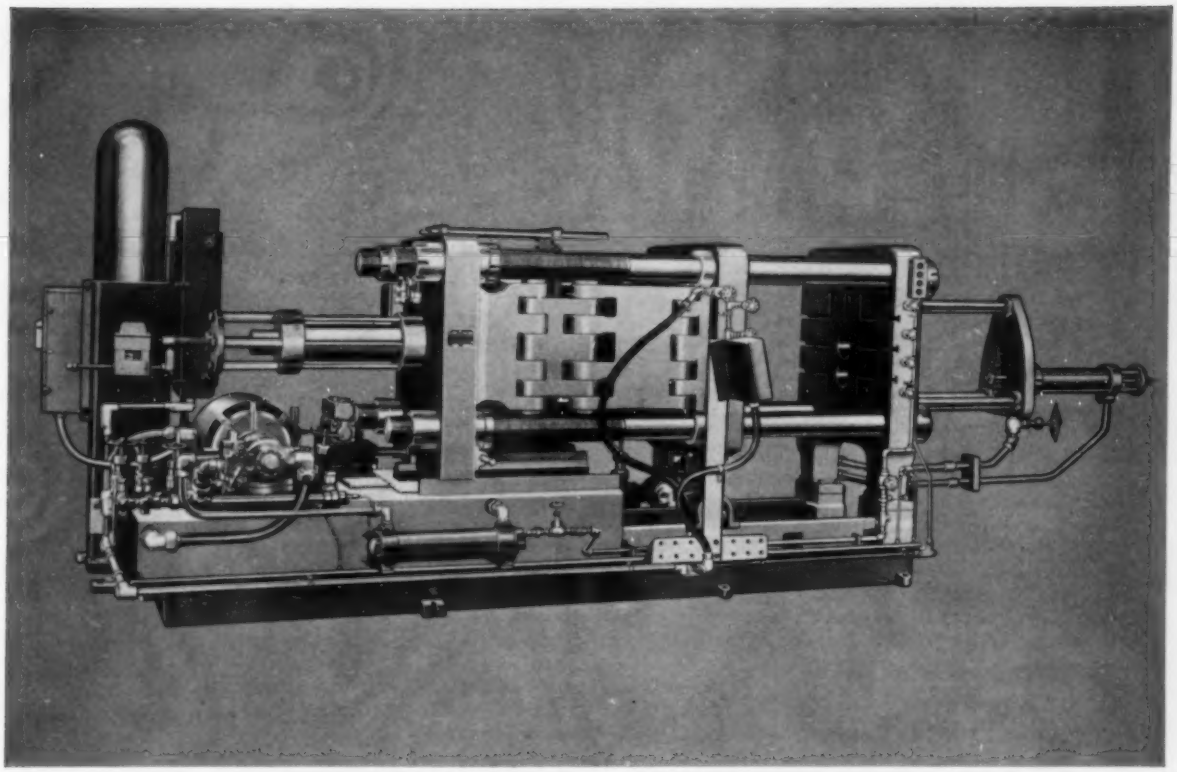

Model B-20A (above) embodies all the features that have made Cast-Master a leader in the die-cast industry... solid steel platens, extra heavy linkage with multiple shear points, telescopic fluid transmission assemblies and many exclusive features combine to make it dependable, efficient and economical to operate.

For performance, economy, safety... fire-resistant Pydraul fluid in Cast-Master machines

Many die casters prefer Cast-Master machines for continous, high production of quality castings. They protect this production with fire-resistant Pydraul hydraulic fluid . . . and stop hydraulic fluid fires before they have a chance to start.

Pydraul is noncorrosive . . . it lubricates like a petroleum oil, and has a longer service life than most other fluids . . . you can return spillage to the system . . . use it again and again.

If your hydraulic equipment is near hot metal, electrical contacts, open flame or other heat sources, you're taking a needless fire risk. Your Monsanto representative will show you how easy and economical it is to convert to a fire-resistant Pydraul system.

Pydraul F-9—first and only hydraulic fluid listed by Underwriters' Laboratories

"In respect to fire hazard, Pydraul F-9 is rated by Underwriters' Laboratories, Inc., 2 to 3 in a class much less flammable than paraffin (Petroleum) oil, according to a schedule in which Ether is rated 100; Gasoline 90—100; Alcohol (ethyl) 60—70; Kerosene 30—40; Paraffin Oil 10—20."

Pydraul: Reg. U. S. Pat. Off.

Write for FREE Pydraul F-9 booklet.
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY,
Dept. OEM-9, St. Louis 1, Missouri

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MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

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Useful Literature

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HYDRAULICS COMPONENTS . . . built by the New York Air Brake Company's Kalamazoo Division are presented in condensed Bulletin No. 400. Gear and dual-vane hydraulic pumps, control valves, and cylinders are fully described, and condensed performance information is included.

Circle 250 on Reader Service Card

AIRCRAFT FITTINGS . . . Fluid power engineers working out design problems will be interested in the tubing hookups shown in The Weatherhead Company's 72-page Aviation Catalog AC-301. Some space limitations may be handled with flareless cluster fittings as illustrated in this booklet. Swivel joint applications shown may also be of help. Catalog gives complete engineering information on their line of flareless fittings, swivel joints, hydraulic cylinders, couplings, forgings, valves and hose fittings and assemblies. Technical data and engineering notes are also included.

Circle 251 on Reader Service Card

TEST GAUGES . . . for fluid pressure measurement in laboratories, production testing, field inspections, test stands and recalibration benches, are given in Catalog 400 issued by United States Gauge, Division of American Machine and Metals, Inc. Complete technical information is given with illustrations of the various gauges. In addition, a section of the bulletin covers the problem of selecting gauges and the solution.

Circle 252 on Reader Service Card

PACKINGS HANDBOOK . . . available from Precision Rubber Products Corporation, should be very useful to fluid power engineers. Booklet gives 52 pages of technical information on O-Rings and Dyna-seal packings. Data covering operating principles and applications of moving and non-moving seals is presented in simple form and clearly illustrated. Booklet includes information on O-Ring compounds and a complete cross reference of military part numbers and specifications.

Circle 253 on Reader Service Card

VALVE GUIDE BOOK . . . published by the Lunkenheimer Company gives 24 pages of tables, technical data and information on the selection of valves, and lubricating devices. Circular No. 555 is completely indexed for easy reference.

Circle 254 on Reader Service Card

AIR COMPRESSORS . . . manufactured by Brunner Manufacturing Company, are described in their data sheet 653-R. Models from ¼ to 20 hp are listed with construction details and specifications. Bulletin provides data useful in selecting the right compressor for a specific job.

Circle 255 on Reader Service Card

LIMIT SWITCHES . . . for machine tool applications are listed in 8-page Bulletin 956 published by R. B. Denison Mfg. Company. Catalog describe 21 contact arrangements, detailing the housing, contact arrangements, wiring diagrams, operating data and electrical characteristics of nine standard models. Bulletin also gives dimensional data and drawings with specifications on three types of top covers, including a plastic watertight model, and six types of mounting plates available. In addition, over 150 types of operating levers are itemized.

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AIRCRAFT SWITCHES . . . for every application are detailed and illustrated in 32-page Catalog 78 published by Micro Switch, Division of Minneapolis-Honeywell Regulator Company. Their complete line of phenolic encased aircraft switches is listed, as well as small, metal-covered, hermetically sealed switches and high-temperature switches. Booklet is complete with photographs, dimensional drawings, electrical data and operating characteristics.

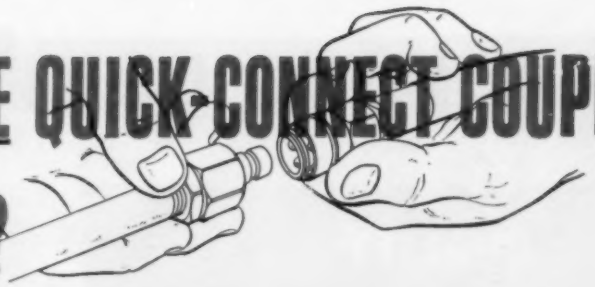
Circle 257 on Reader Service Card

FIRE-RESISTANT LUBRICANT . . . for air compressors is discussed in Technical Bulletin 0-133 published by Monsanto Chemical Company. Use of Pydraul AC fluid in place of petroleum oil reduces hazards of air compressor explosions and receiver fires. Compressor maintenance is reduced as formation of carbon deposits on exhaust valves and air system components is minimized. Physical properties of the fluid and instructions for the conversion of compressors to its use are covered.

Circle 258 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 163

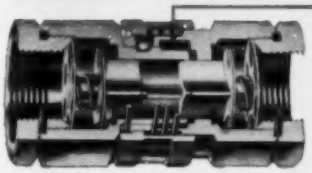
WHICH SNAP-TITE QUICK-CONNECT COUPLING IS BEST FOR YOU?



SNAP-TITE "H" COUPLING . . . . . FOR HIGH PRESSURE APPLICATIONS

FOR HYDRAULIC OR AIR

"H" Coupling for high strength, higher efficiency, high-resistance to heavy line surge. Sizes: ⅛" thru 12". Bulletin No. 240

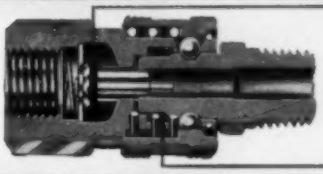


Exclusive U-packer gives a positive seal without compression set because of rubber distortion. Line pressure inside the U-packer keeps it open and forced against its metal backing—the higher the pressure, the tighter the seal.

SNAP-TITE HI-FLOW COUPLING . . . FOR LOW PRESSURE APPLICATIONS

FOR AIR AND FLUIDS UP TO 150 p.s.i.

Hi-Flow is recommended to connect small air tools to plant air system, and for low pressure fluid transfer in small lines. Sizes: ⅛" thru ¾". Bulletin No. 230

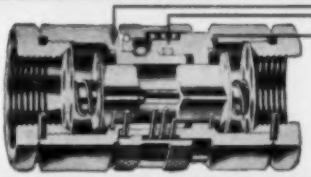


Bonded valve washer
(pat. pending on valve construction)

Exclusive U-packer

SNAP-TITE "HK" COUPLING . . . . FOR HARD TO HANDLE FLUIDS

FOR FUMING ACIDS, ALKALIES, SOLVENTS, AND HIGH PRESSURE STEAM . . . "HK" is the only coupling now on the market for fluid temperatures from —100° F to +500° F . . . and for live steam up to 460° F. Its seals are made of Teflon for which there is no known solvent. Sizes: ½" thru 3". Bulletin No. 270



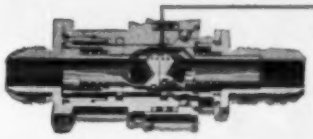
Teflon Valve Seal

Teflon Nipple Seal

Teflon Valve Seal

SNAP-TITE NO-SPILL COUPLING . . . FOR MINIMUM AIR INCLUSION

FOR AIRCRAFT, MISSILE HYDRAULIC, FUEL SYSTEMS which cannot stand air in the lines, and for transmitting fluids which *must not spill*, the Snap-Tite no-spill coupling is recommended. Bulletin No. 280



Flush valves prevent spillage, air inclusion. Snap-Tite will engineer special variations to your requirements.

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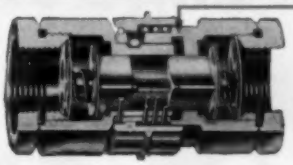

Nipple seals in coupler by depressing the lip of the E packer and slightly compressing the body of the packer. This new E-packer gives positive seal under high-pressure, low-pressure, and vacuum.

Snap-Tite Couplings are available plain, (without valves), and with either single or double shut-off. Couplings normally furnished in alloy steel, but all (except hi-flow) are also available in brass, aluminum, or stainless steel with a variety of finishes.

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The recognised Keelavite standards of high quality maintained throughout.

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Patented features include precision hydraulic location, eliminating wear plates

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Four components only achieve the ultimate in simplified construction.

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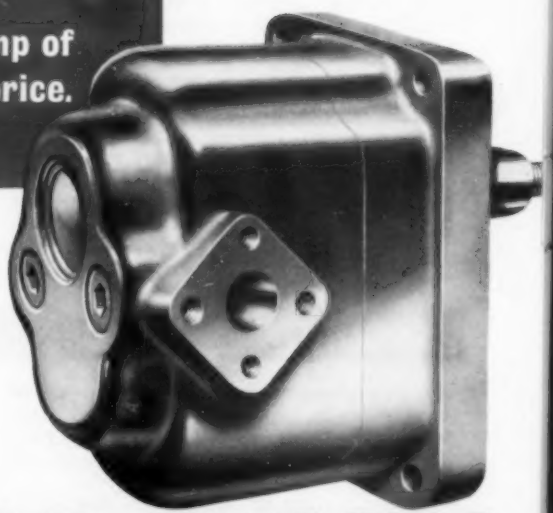
The end result is a quality pump of high efficiency at a very low price.



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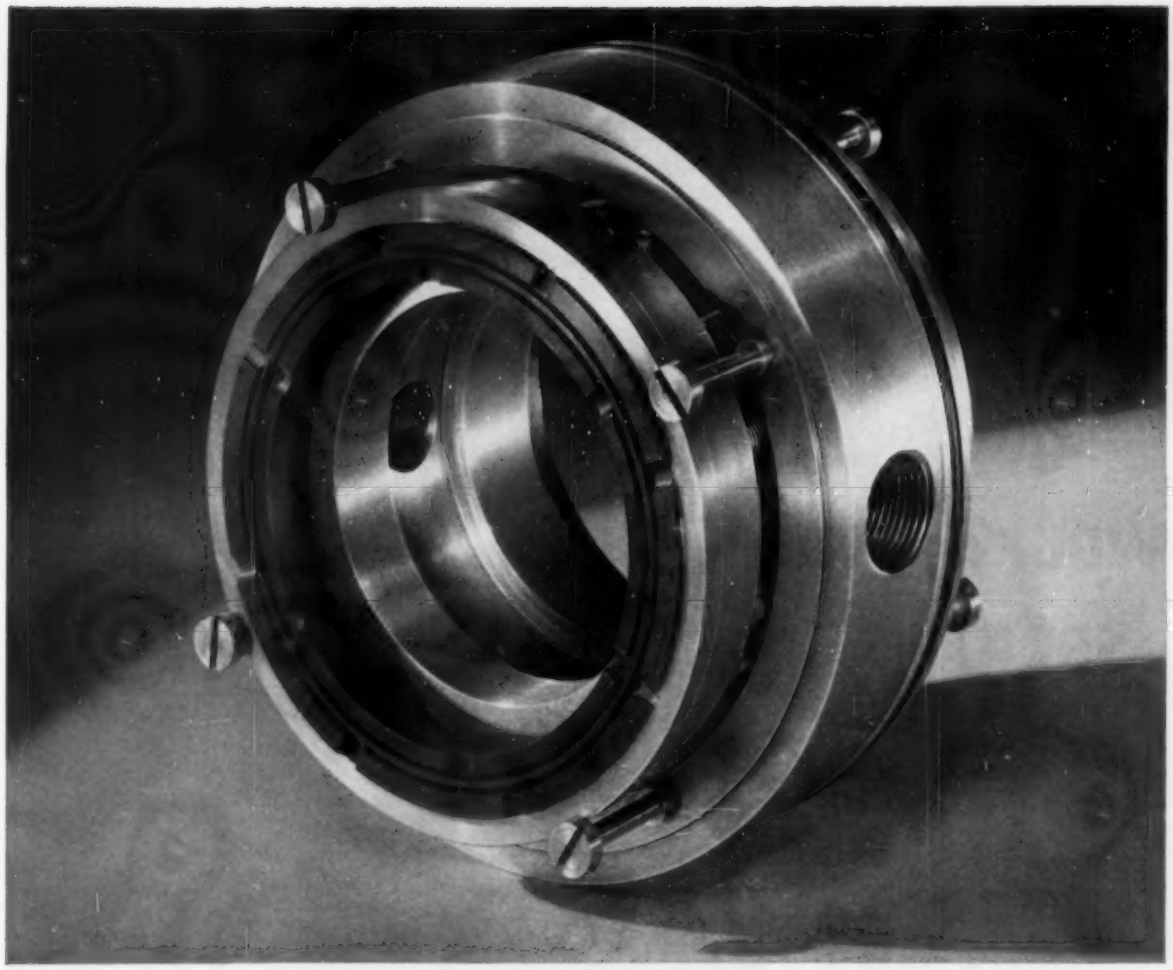

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Up to 30,000 Hours in Laboratory Tests Using Clean Gas!

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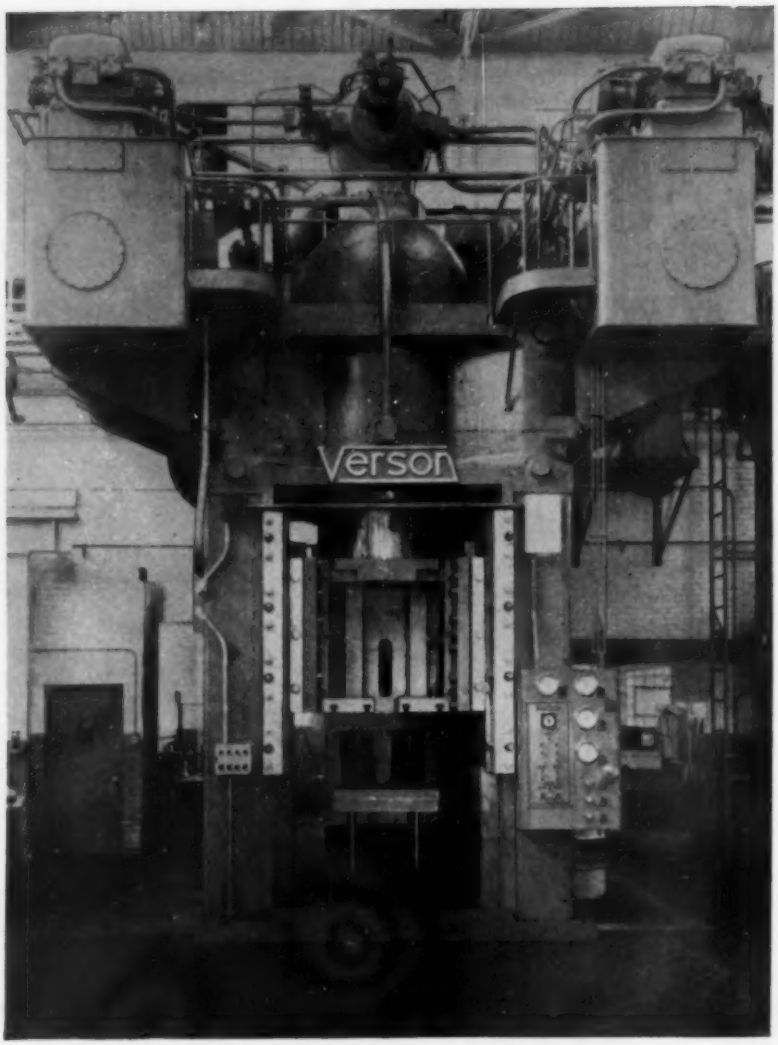
MECHANICAL SHAFT SEALS

What hydraulic fluid would you specify?



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FOR ALL HYDRAULIC UNITS

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Circle 156 on Reader Service Card

Nine years of experience proves it is possible to increase three fold, the life of pump parts, by the correct location of magnetic plug assemblies in the flow path of the fluid in the tank. Abrasive steel particles are magnetically held on the plugs. This prevents their entrance into the pump where they would act as a lapping compound.

How to design and use . . .

MAGNETIC PLUG ASSEMBLIES

. . . in hydraulic reservoirs

• By J. Russell Hemeon

DO you obtain 3 to 5 years life from highly loaded pumps? Or are you satisfied with worn out pumps after 1 to 1½ years of questionable service?

Extended hours of service can be achieved when magnetic plug assemblies are design located in the hydraulic reservoir. Application of these plugs has been one part of engineering development work aimed toward and resulting in improved performance of hydraulically powered equipment.

Specification of magnetic plug assemblies which are properly engineered into the reservoir design is considered a necessity on equipment having close tolerance pump and valve parts.

The photographs illustrate actual experience dating back to 1947 with hydraulic die casting and metal working machines. Figure 1 shows initial 1948 test results. Three plugs at the end of a six plug assembly are shown. This original plug was made from round bar stock, with a slot milled down the center. The base was made from plate steel welded construction. In this test run, there had been an initial period of seven months with two removals for examination and cleaning. This schedule insured complete removal of all residual abrasive particles. Figure 1 shows what was worn away from the pump parts and magnetically trapped by the plugs over an extended period of 15-½ months or 4,300 hours. There were four pumps on the machine. At

J. RUSSELL HEMEON, *Hydraulic Equipment Engineer, Ternstedt Div., General Motors Corporation, Trenton, N. J.*

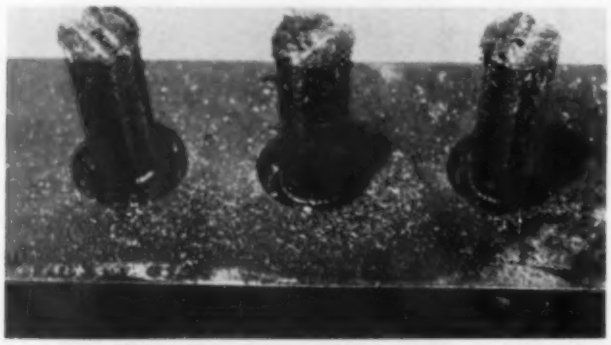
a subsequent examination after 12,300 hours at 650 psi, the pump ring wear surface was mirror smooth with a loss of 50 milligrams or 0.027% of its original weight.

Figure 2 shows the 1952 design modification of the magnetic plug made from flat bar stock with a 180 degree U bend hidden in the base. Machine construction was supervised under laboratory clean precision. Every piece of tubing was thoroughly cleaned before and after processing. All fittings, valves, and controls were solvent cleaned. At the end of the construction, the reservoir was dry cleaned and wet mopped to insure no loose particles. Double filtered oil was used. In spite of all these precautions, abrasive particles as shown in Figure 2 were trapped by this four plug assembly in the first two hours of operation.

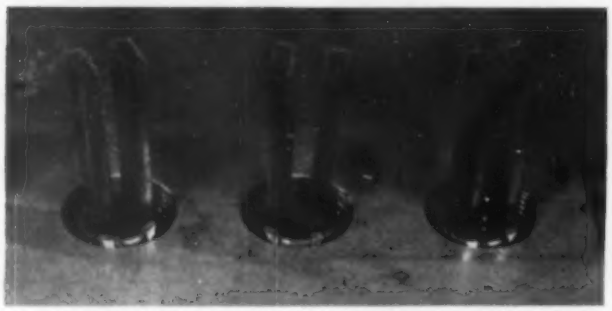
Figure 3 shows the 1955 final modification of a two plug assembly. There are two cylinders of Alnico II on each plug. A central brass core is swaged into a cast iron bottom piece. The base frame, which is less expensive, is now made from a 4 in wide by 1¾ in deep steel channel section. The plugs are spaced on 3⅛ in. centers. Straight threads, 1½-12 are tapped in the channel.

Figure 4 shows a four plug assembly, 1955 final design, loaded with particles after the first 500 hours of operation. Note the four horizontal planes of magnetic field intensity. The top of the plug traps the fine high floating particles. The bottom of the lower magnet traps the larger and heavier particles, which have partially settled.

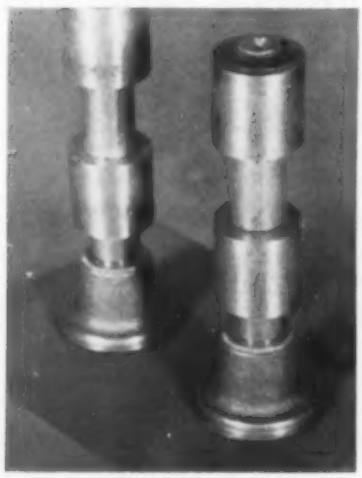
Examination of the particles on these plugs showed some large chips which would jam a pump not protected by an



1947 **FIG. 1. Initial test results are illustrated by these three plugs of a six plug assembly which was first installed 9-30-47. Cleaned 1-16-48 and 4-20-48. Photo taken 8-5-49 after 4,300 hours of service since previous cleaning.**



1952 **FIG. 2. Magnetic plug assembly designed in 1952. Photo shows pickup of particles after the first two hours of service on a machine built with extreme care to insure cleanliness.**



1955 **FIG. 3. Final modification of a plug assembly was made in 1955.**

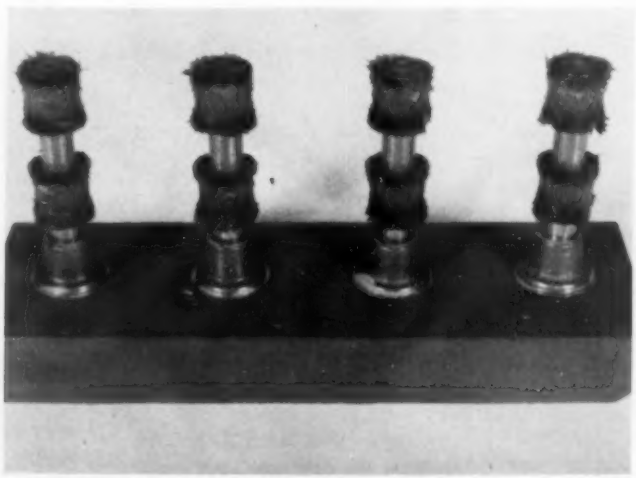


FIG. 4. Four-plug assembly loaded with abrasive particles in the first 500 hours of operation. Alnico plugs are mounted on a channel section base.

intake filter. Particles build up in the horizontal planes, at the top and bottom of each cylindrical Alnico magnet.

TANK DESIGN

Design of hydraulic reservoirs must be given careful consideration. The major objective has been to construct a tank which will effect an important part in dissipating heat and removing contaminants. Figure 5 illustrates major features in reservoir design. A center baffle plate is used. Return tubes deliver fluid to the return side of the baffle. All return tubes are submerged and have a 90 degree bend in the tubing. The discharge end of the tubing is in a horizontal plane approximately 3 inches from the tank bottom. Furthermore, the tubes are so located to direct the fluid flow along the return fluid side of the baffle plate. This will establish a peripheral flow path along the inside tank walls to obtain optimum heat dissipation to the cool air at the floor level. This fluid flow pattern is directed over the magnetic plug assembly which is a semi weir at the right side of the tank. This weir condition is illustrated in the elevation view of Figure 6. With the channel section 1-¾ in high, the top of the plug is at 6-15/16 in, which establishes a full oil level of 7-½ in, and a net inside tank height of 9 in.

The plan view shows that one channel leg aligns with the baffle plate. This arrangement blocks the flow of large particles which have been settling on the bottom of the tank. After three years of service, this feature will show a complete black film of heavy particles on the floor of the return side, and clean floor on the intake side. If the magnetic plug assembly is centered on the baffle plate, there is no lower-level dam by the channel leg; and minute particles flow into the suction area, enter the pump and decrease full pump life expectancy.

Furthermore, two ⅜ in square lengths of steel bar stock are tack weleded to the base plate to prevent the channel base from shifting.

HOW MANY PLUGS SHOULD BE USED?

The number of plugs in a magnetic plug assembly is based on optimum flow velocity over the weir. Add up the total pump delivery in gpm and use the following table to determine how many plugs in an assembly.

NO. OF PLUGS	WEIR LENGTH	MAX. GPM
2	6⅛"	12
3	9¼"	18
4	12⅜"	26
5	15½"	33
6	18⅝"	38

Example: A two pump design, using pumps rated at 19 and 7-½ gpm, should use a four plug assembly with a maximum gpm flow capacity of 26.

Design the tank with the valve chamber over the magnetic plug assembly. Maintenance servicing of plug assemblies, cleaning, and replacing can be accomplished with a minimum downtime.

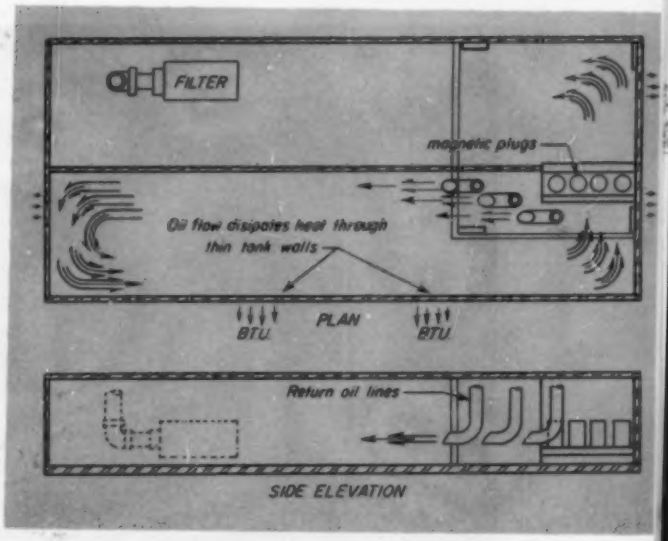


FIG. 5. Hydraulic reservoir is designed with the magnet plug assembly as a weir which is aligned with the mid-tank baffle.

PREVENTIVE MAINTENANCE SCHEDULE

Under normal conditions, the preventive maintenance schedule for magnetic plug assemblies specifies:

1. Remove and clean after the first 500 hours of initial operation.
2. Remove and clean every 5,000 hours thereafter.
3. Check Alnico plugs for magnetic field intensity every 15,000 hours and replace weak plugs.

All hydraulic tanks built for our equipment include magnetic plug assemblies. Studies made of service life, maintenance and downtime with equipment using these assemblies have clearly demonstrated their value. ▼▼▼

ADDITIONAL MATERIAL on keeping hydraulic circuits clean is contained in the following articles:

1. "Where Should A Filter Be Located In A Hydraulic System?" *Applied Hydraulics,* Aug. 1954.
2. "Oil Filters for Hydraulic Systems." A. McHugh, *NCIH proc. Vol.* 5, 1952.
3. "How To Keep Oil Systems Clean," A. R. Morse, *Applied Hydraulics,* Feb. 1952.
4. "Reduce Operating Costs With Purifiers," *Applied Hydraulics,* Feb. 1951.
5. "Oil Filters—What They Are—How and Why They Are Used," D. G. Van Vleck, *Applied Hydraulics,* Nov. 1950.

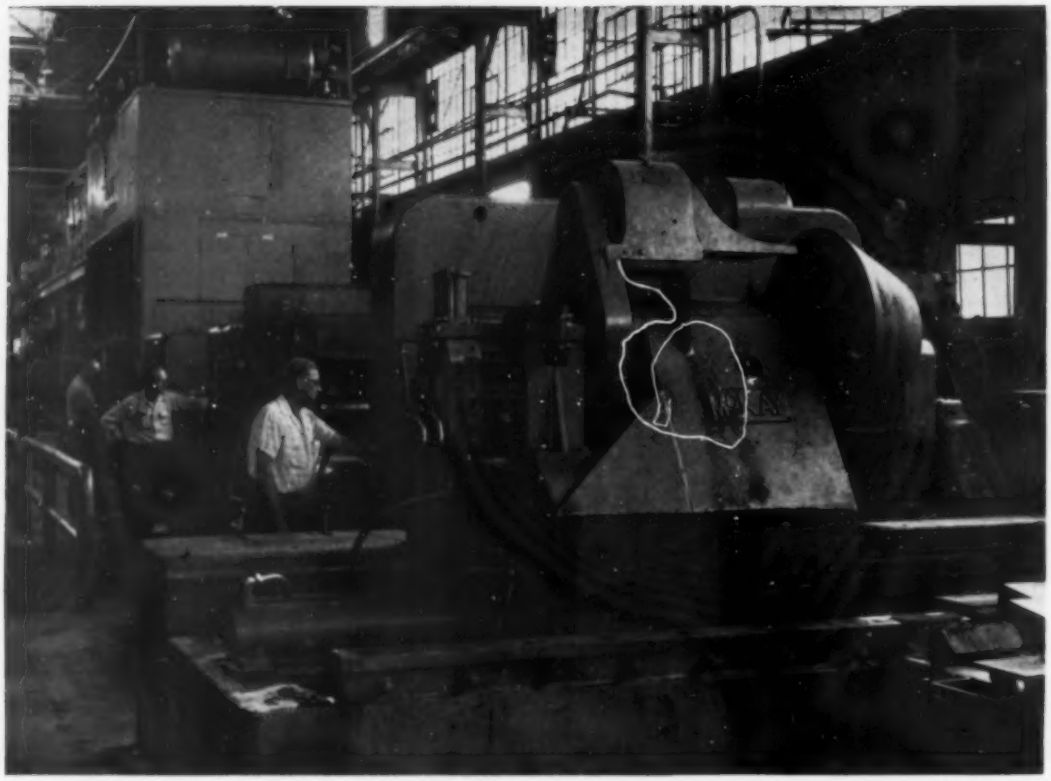


FIG. 1. FEEDING A 99-INCH SIZING PRESS cutting steel sheets for auto parts requires units for cleaning the stock and relieving strains. Safety features of manual controls prevent dropping coil.

SAFETY . . . *with*

Safety is the big thing when
a 30-ton coil of steel is being handled.
Proper positioning means safety
to men and equipment.
Designers carefully sized cylinders,
selected pressures and
built in mechanical safety locks.

● By Paul McCreary
and Kenneth Bandy

LOADING a 30-ton coil of sheet and feeding it through several processing units to a press called for reliable safety controls in the manually operated hydraulic system. Engineers at McKay Machine carefully worked out counterbalancing for the coil holding cylinders and coil lifting cylinder. The equipment built for Ford Motor Co., was designed with a mechanical lock maintained hydraulically with the use of an accumulator. Because the pump is not running while the coil is locked in place, accidental operation of the valves has no effect.

The coils are supported on each side by two cone-shaped holders which are mounted on ways and driven by individual cylinders. Each cone can

PAUL MCCREARY, *Chief Engineer,* KENNETH BANDY, *Design Engineer, McKay Machine Co., Youngstown, Ohio.*

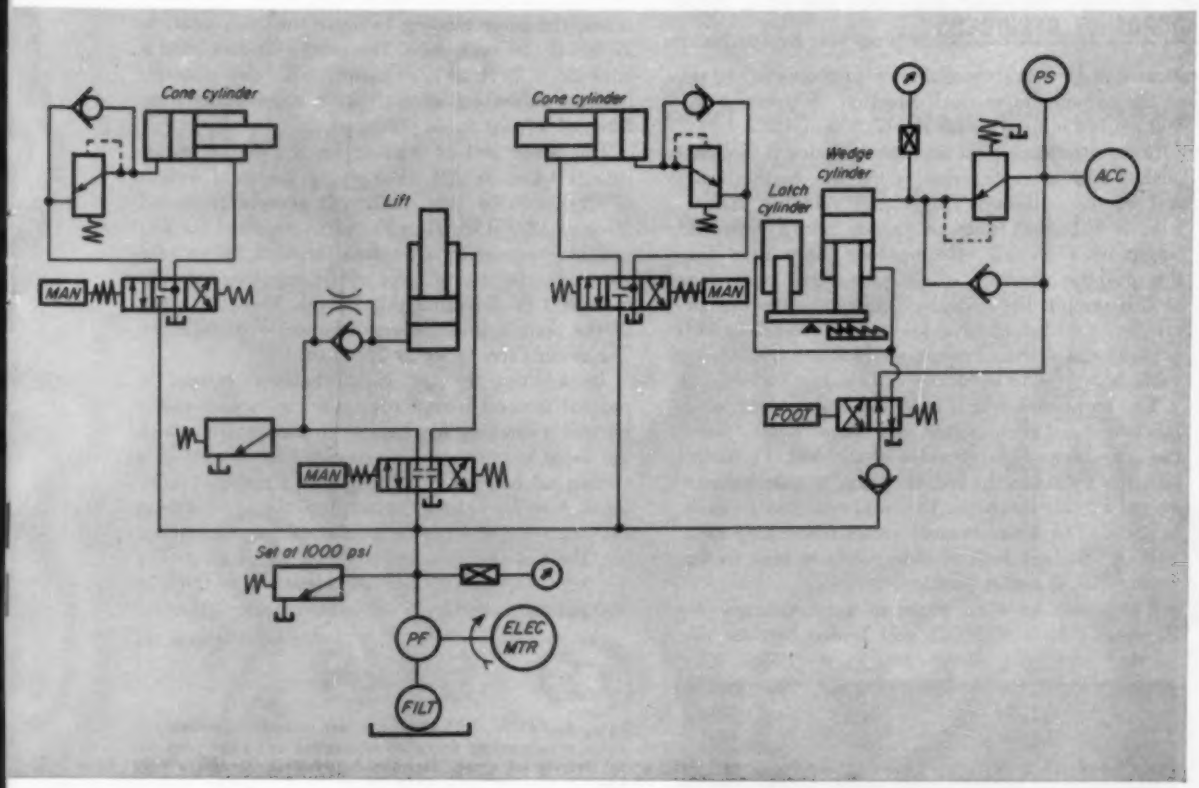


FIG. 2. DRILLED CHECK VALVE for counterbalancing lift cylinder is represented by check valve and flow control valve in parallel. Latch cylinder and wedge cylinder act on opposite sides of a lever arrangement.

manual controls

be moved in and out or stopped in any position. The cones rotate on bearings, and sheet steel is pulled from the coil by pinch rolls of the cleaning unit which is next in line.

Each of the opposing cylinders is controlled by a manual valve, so that while the coil is held between the cones, it can be moved to either side for alignment. This requires that cylinder force in one direction overcome cylinder force in the other direction. This is accomplished by using counterbalance valves in a circuit which insures sufficient force on the coil at all times to prevent dropping it.

Coils of sheet steel to be processed for automobile hoods, tops, and other body sections are loaded on a coil car which is part of the coil holder.

FIG. 3. COIL HOLDER PUMP is started by push-button control when mechanical lock is not applied by pressure on the wedge cylinder.

The coil car is electrically driven on tracks to a position below the cones.

A lift cylinder in the coil car is then actuated through a 4-way, closed-center manual valve to raise the coil to the level of the cones. This cylinder has a bore of 10½ inches and a stroke of 19¼

inches to permit reasonably accurate positioning of the coil in the vertical direction. A pressure of 700 psi is required to lift the 60,000-lb. load.

Counter-balancing of this lift cylinder is accomplished with a check valve in the line to the head end of the cylinder. This check valve is drilled with a 5/16-inch hole to permit return flow. A length of 5/16-inch tube has also been used for this purpose. Because of the infrequent operation of this circuit, the drilled check valve provides an effective and inexpensive counterbalance valve, and protects the system against shock when the 4-way valve is opened to lower the coil during loading.

The two cones which hold the coil are actuated by two parallel-connected cylinders which force the cones into opposite sides of the coil. To maintain the cylinders locked in place, counterbalance valves are connected in the head-end line to each cylinder. The 4-way manual valves controlling each cylinder connect both cylinder ports to tank in the spring-loaded center position.

The cones have an angle of approximately 30 degrees. With a 60,000-lb coil loaded between the cones, the force tending to move the coils apart is 17,500 lb. on each cone. The cone cylinders have a bore of 8 7/16-inch diameter, with the counterbalance valves set at 400 psi a counterbalancing force of 22,400 lb. is produced.

The coefficient of friction for the sliding members is taken as .20. Multiplying the total weight of 60,000 lb by this coefficient gives a frictional force of 12,000 lb. Thus the force required for one cylinder to overcome the total friction forces plus the counterbalancing force of the opposing cylinder is 34,400 lb. Dividing this by the 56 sq. in. area of the cone cylinder gives a pressure of 613 psi. The relief valve is set at 1000 psi.

In addition to the counterbalance system to prevent the coil from falling, the coil holder incorporates a latching mechanism to mechanically lock the cones in position. This mechanism consists of a sliding ratchet connected to one of the sliding cone units. A wedge cylinder attached to the other sliding cone element is actuated to contact the ratchet and pull the two sliding cones together for locking. The 4¼-inch wedge cylinder is actuated by fluid at 400 psi controlled by a pressure reducing valve.

Concluded on page 118

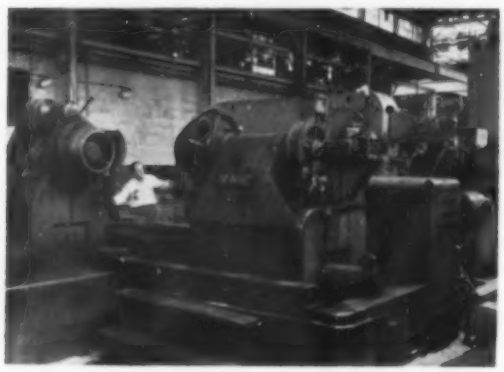
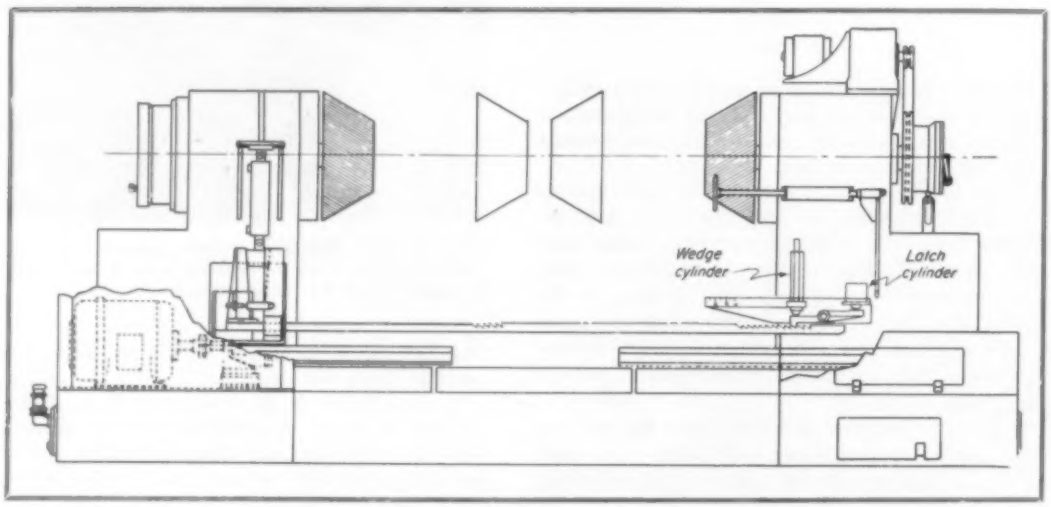


FIG. 4. CONE CYLINDERS are sized to overcome counterbalancing force of opposing cylinder plus total frictional drag. Required pressure is about 600 psi.

FIG. 5. LOCKING RATCHET is attached to left cone unit and slides in right cone unit. Wedge cylinder locks cone units in place. Latch cylinder raises lock when cones are to be moved.



What does the hydraulic designer need to know about relays and contactors? If there are solenoid valves in your system, chances are the electrical circuit has relays. If you're using an immersion heater in your oil reservoir, it's probably switched on and off by a contactor.

RELAYS and CONTACTORS

15 Questions to Ask When Specifying Relays

1. What kind of a load is to be controlled? Is the load reactive? Will it take a large inrush current?
2. How frequently must the relay operate?
3. What will the maximum ambient temperature be? What temperature extremes will be encountered?
4. Is the relay to be used on a-c or d-c? If a-c, at what frequency?
5. At what voltage must the relay operate? Standard voltages run from 6 to 600 volts.
6. What is the current rating of the relay coil?
7. How much power is required to operate the relay?
8. Is operating speed critical? Must certain contacts make or break before others?
9. Is a slight time delay required?
10. Are special contacts required?
11. What type of terminals are required?
12. What type of enclosure is required?
13. How much vibration will the relay be required to withstand?
14. How many operations should the relay be able to withstand?
15. Will the installation provide ventilation? If it does not, the relay may have to be de-rated accordingly.

● By Allan E. Morris
Associate Editor APPLIED HYDRAULICS

IN a fluid power electrical control circuit, the relays multiply control signals from such devices as pushbuttons, timers, and pressure switches to actuate solenoid valves or other relays. The relay coil is energized by a single signal from one of these devices. This in turn energizes the relay magnet actuating movable contacts and switching the load circuits.

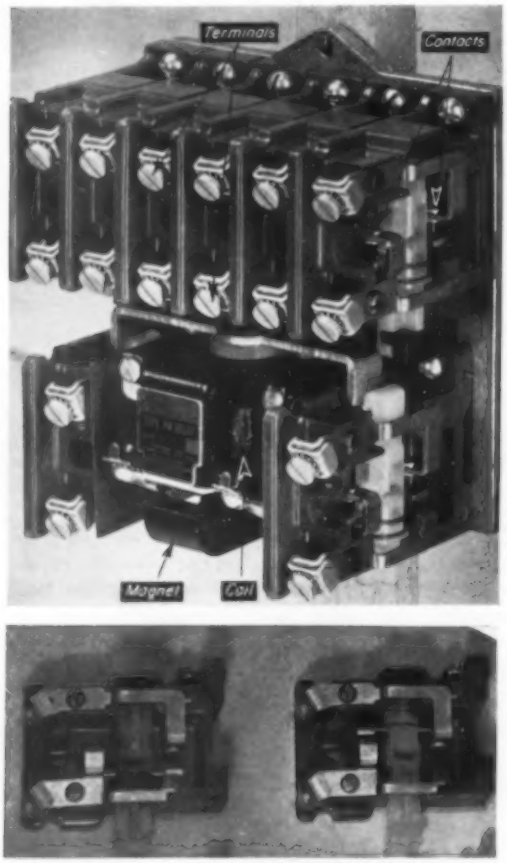
The principle factors in selecting a relay or contactor are the characteristics of the coil or actuating circuit, and the contact or load circuit. These characteristics determine the voltage and frequency of the operating coil, number of poles, combination of normally-open or normally-closed contacts, and whether some contacts must open or close before others. Other facts such as the atmosphere in which the relay must operate, how it is to be installed, and how frequently it will operate must also be considered when the relay is specified.

RELAY CONSTRUCTION

The principal components of an electromagnetic relay or contractor are the contacts, coil, magnet,

springs, terminals, and mounting. Relays and contactors have essentially the same construction, differing mainly in their current interrupting capacity. Relays for general control are rated at 10 or 15 amperes. Contactors are rated from 10 amperes ac and 25 amperes dc to 2500 amperes ac and dc. Almost all d-c contactors, and a-c contactors in the higher current ratings incorporate means of extinguishing the arc which forms when the contactor is opened.

In addition to these standard components, latching relays have a mechanical latch which locks the contacts in the actuated position when the relay is energized. This permits the signal to be removed after the initial actuation. The mechanically held relays are used to maintain continuity of sequencing in case of power interruption, so that operation will resume at the exact point in the cycle where the power was removed. Another application for this type of relay is where very quiet operation is required. The mechanical latching eliminates the characteristic hum of a-c relay coils. Latching relays have an auxiliary coil which is energized to release the latch.



Courtesy Clark Controller Co.

FIG. 1. DESIGN OF THIS TYPE RELAY permits simple removal or addition of individual poles. Contacts can be converted from normally-open to normally-closed. Lower view shows pole assembled as normally-open (left) and normally-closed (right).

CONTACTS

Relays are available with as many as twelve poles or moving contacts, and contactors with as many as four. The number of poles specified depends on the number of circuits to be switched, since each pole is connected in a separate load circuit.

All poles are actuated together and may be either single-break or double-break which refers to the method of opening the circuit. Double-break contacts open the line at two points. This divides the arc into two parts each of which has half the voltage of a single-break contact. Consequently, for the same opening distance, double-break contacts have about three times the interrupting capacity of single-break contacts. Another advantage of double-break contacts is that they do not require a flexible pigtail connection to the contact and thus have better life.

Relay or Contactor?

The difference between these two is mostly a matter of current interrupting capacity. In fluid power design, the relay is a control circuit component, switching timers, solenoid valves, and other relays. Contactors are connected to switch the higher current loads such as oil immersion heaters.

Contactor contacts are normally-open. Relay contacts may be normally-open or normally-closed. This refers to their position with the coil de-energized. Most industrial relays permit changing from one condition to the other. One manufacturer supplies a 4-pole relay which has both normally-open and normally-closed contacts on each pole. Connections to the relay terminals can then be made to use either of these contacts.

Poles are also classified as single-throw and double-throw. A single-throw pole performs a single function of opening and closing one line. A double-throw pole switches a common line between two branch lines.

Although all poles of a relay are actuated together, sometimes it is necessary for certain contacts to open or close before others, such as in transferring a load from one source to another. This can be accomplished in the design of the relay and is referred to as overlap. In the standard relay with non-overlapping contacts, the normally-closed contacts open before the normally-open con-

tacts close. This is called break-before-make. In the relay with overlapping contacts, the normally-open contacts close slightly before the normally-closed contacts-open. This is referred to as make-before-break.

In specifying the number of poles, extra poles are sometimes considered for use in future modifications of the machine. The advantages of having this flexibility may be offset by the disadvantages of increased initial cost and increased power required to operate the relay. In the relay illustrated in Figure 1, the addition of poles is very simple, and the relay can be purchased with space available for future poles. Several coil sizes accommodate from 2 to 12 poles.

In contactors the rating of the contacts is the continuous current which they can carry and interrupt. In a-c contactors inrush current to an inductive load will be higher than normal, steady-state current. A good rule is to specify a contactor so that inrush is not more than 2½ times the continuous current rating. This should insure good contactor life.

Ratings of a-c contactors are usually given in terms of horsepower as well as 8-hour (continuous) current, since contactors may be used for electric motor circuits if overload protection is not required, or if it is provided by other means. The ratings must be lowered for inductive loads and for lamp loads. In lamp loads the cold resistance of the filaments is much lower than the hot resistance, so that the inrush current is correspondingly higher. A thermistor, or negative-coefficient resistance, is sometimes used to counteract this effect. The resistance decreases as the thermistor heats up, so that the total resistance of the circuit can be maintained almost constant.

What About Maintenance?

The best thinking on how to take care of relays is—if they're working O.K. leave them alone! Properly selected and installed, a relay should require no further maintenance. Just how long they'll last depends entirely on the application. When they do fail, it's usually more economical and practical to replace the entire relay than to change the faulty contacts or coil.

Most d-c contactors, and a-c contactors in the higher voltage and current ratings have means to break the arc which forms when the contacts are separated. Frequently this is a magnetic blow-out in which the arc is magnetically drawn out until it breaks and is extinguished. Arcing is not as much of a problem in a-c contactors because the current and voltage are constantly passing through zero, so that the arc tends to extinguish itself.

Relay contacts are usually silver or a silver cadmium alloy because of the excellent electrical conductivity of silver, and the fact that silver oxide which forms on the contacts is a conductor. The addition of a small amount of cadmium to the silver increases the interrupting capacity of the contacts. For certain applications, other metals such as platinum, palladium, molybdenum, and copper are used. Graphite-impregnated or pure carbon contacts may be used to prevent sticking.

Contact resistance which is the most important factor in contact heating is a function of the force pressing the contacts together. Another factor in contact resistance is dirt and corrosion. Continous

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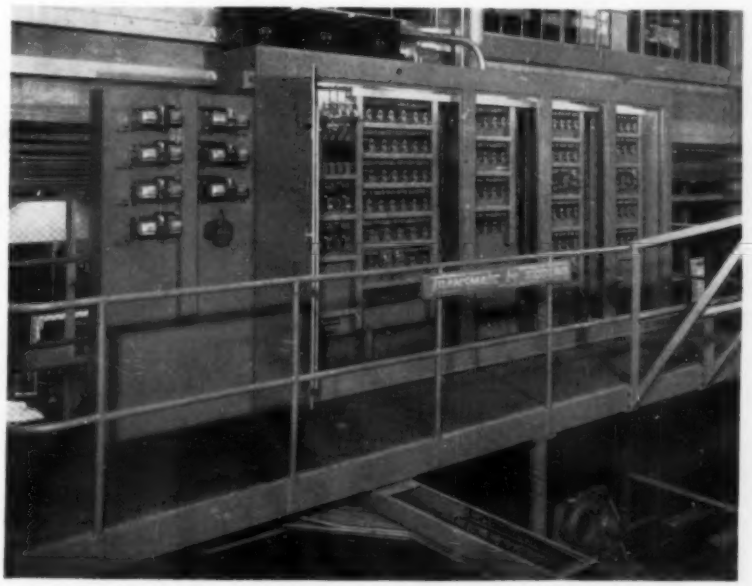

FIG. 2. ELECTRICAL AND HYDRAULIC controls for a large transfer machine. The seven solenoid controlled valves, panel mounted at left, are controlled by limit switches on the machine and push-buttons which actuate the relays in the panels at right.

FOAM RUBBER products are produced on this line of presses. A booster circuit controlled by three timers powers each press.

STANDARD BOOSTERS

...speed press construction

USE of air-oil boosters to power foam rubber production presses played a big part in speeding press design and construction. A prototype was approved within six months after first discussions between the user, Firestone Industrial Products Company; the press builder, Acme Industrial Equipment Co. and the circuit specialists, Gibson Engineering Company. Thirty presses were then built and installed in less than three months in Firestone's Fall River, Massachusetts plant.

The air operated booster system on each press powers four oil cylinders (4 in bore x 8 in stroke) to actuate the platen. The platen is closed with oil at air line pressure by means of putting air on top of oil in a reservoir tank. After closing, the booster permits a wide variation of hydraulic pressures by means of regulating the air pressure on the input side. The booster consists of a 6 inch diameter air cylinder driving a 2 inch diameter hydraulic ram and has a 12 inch stroke. This booster has a 9 to 1 ratio and will develop 720 psi oil pressure from 80 psi air input. Gravity returns the platen.

The cover is operated by two low pressure hydraulic cylinders (6 in bore x 16 in stroke). It is raised by oil at air line pressure by means of air pressure on oil in a reservoir tank, and lowered by gravity. Safety ratchets are operated by two air cylinders (1-½ in bore x 4 in stroke) and locking pins are actuated by two air cylinders (2 in bore x 3 in stroke).

Three timers are used to control the functions of the press. Two of these are multiple circuit reset timers. The third is a single circuit reset timer and is used to assure that the platen closes completely at low pressure before the booster is actuated.

These presses handle a large variety of sizes and thicknesses of molds. Control of the pressures and temperatures is exact. Flexibility of cycling is required by different sizes, thicknesses, and complexities of the molded parts. ▼▼▼

LETTERS
to the editor
AH's December issue which covered Hydraulic Transmissions for Mobile Equipment made me wonder if any manufacturers of passenger cars are considering this type of transmission. Did AH's editors check into this when they prepared that issue?
R. A. B.
Detroit, Mich.
We did plan to have an article in December discuss the possibilities of applying a hydrostatic transmission to automobiles. A check with the "Big Three" auto makers didn't produce anything. So we gave our European Editor, John Lankester, the suggestion that British auto industry might be more interested. He discussed it with Ian McNeil who is a leading British hydraulic engineer. Mr. McNeil has expressed his ideas in the article published here.

WHY NOT HYDROSTATICS

...for automobile transmissions?

• By Ian McNeil

EVEN in its most modern form, the gasoline motor is far from efficient and surprisingly unsuitable as a propulsion unit for the automobile. Its output torque characteristics nowhere near match the vehicle requirements. A new era of motoring is doubtless offered by the gas turbine, but it looks as though many years will elapse before this type of propulsion becomes an economic and practical proposition for the ordinary motorist. Meanwhile, we must continue to make the best of gasoline and the internal combustion engine, with excursions into the field of the compression ignition oil engine.

But the question arises, "Have we to date made the best of the internal combustion engine?"—and what do we mean by "making the best" of it? Literally this entails developing it to the highest peak of perfection and efficiency and giving it optimum working conditions by providing a transmission that will make the most of the engine's inadequacy. We can reasonably expect further progress in engine design in future years, but this is not likely to be substantial or to affect the fundamental characteristics of the engine. At the same time, the only change likely at the driving wheel end of the transmission is that the call will be for greater performance in terms of top speed, acceleration and traction. What, then, can be done about improving the transmission?

• **Requirements**—Any vehicle transmission must meet these requirements:

1. Enable disconnection of engine from driving wheels.

2. Allow smooth connection of same while engine is running.

3. Provide variable "leverage" between engine and wheels.

IAN MCNEIL, *London, England, is author of the book HYDRAULIC OPERATION and CONTROL of MACHINES*

4. Give an overall speed reduction of around 4 to 1.

5. Turn the drive through 90 degrees.

6. Allow differential motion of driving wheels.

7. Permit relative motion between engine and wheel shafts.

• **Drives**—Obviously even the most primitive of drives must have fulfilled these demands in some degree or early automobiles would not have functioned at all. They travelled but left a lot to be desired. From the dawn of the automobile age progress in transmission design has been continuous so that today the driver of an automobile has a smooth and comfortable ride with little effort beyond having to set his vehicle in motion, steer it, and stop it when necessary or desirable. But at what cost? The transmission that allows this is (a) unbearably complex, (b) prohibitively costly except for mass-produced large automobiles, and (c) inefficient to a degree that, combined with the inherent inefficiency of the engine, makes fuel consumption disagreeably high.

The idea of using hydrostatic drive in the automobile is certainly not new—patents on it exist as far back as 1910. Why then has the use of hydrokinetic devices in transmissions advanced while the hydrostatic pump and motor drive remains still a visionary dream? In spite of its advantages, the torque converter in automobile drives is usually found coupled with a friction clutch, a planetary gear box and very often an overdrive. It does little to simplify transmission design. Hydrostatic variable speed and variable torque drives are used in almost all fields of industrial power transmission, but are rarely found in transportation applications. The answer is probably tradition and the pursuit of what is known to be practicable. Even in engineering design we exhibit gregarious tendencies and a mechanism that will work for one man will perform equally well for another. He may possibly improve on it.

• **Ideal drive**—There are many possible variants of the hydrostatic drive, but as we are dealing in the realms of fancy—or perhaps theory—rather than fact, we may just as well go the whole way and take a look at the complete or ideal hydrostatic drive. What would it consist of? Is it feasible?

A variable-capacity pump, vane, radial piston or swashplate type, is connected directly to an internal combustion engine output shaft. It is connected through a suitable control valve and distributing valve to two or four hydraulic motors—most probably of the fixed capacity type. A pressure relief valve is incorporated rather to safeguard the system than to limit the maximum torque transmitted in driving. With the connecting pipework and a fluid reservoir, this constitutes the whole basic system. This arrangement would replace the following components of the orthodox transmission: clutch, gearbox, propeller shaft, differential, half-shafts and back-axle casing, and brakes on all the driving wheels.

• **Speed ratio**—With the mechanical clutch and gearbox, the maximum tractive effort in each gear is exerted at the road-wheels at an engine speed which corresponds to the maximum engine torque. In most gasoline engines, this speed is a little above midway between zero and maximum engine speed, a typical value being, say, 2500 rpm maximum torque, with a full engine speed of 4800 rpm. It should be noted that this speed of 2500 rpm will also be very close to the speed at which the fuel consumption is at its lowest level in terms of lbs/BHP-hour. Using 6.50 x 17 tires, to produce a maximum road speed of 90 mph at 4800 rpm engine speed, will mean a road-wheel speed of about 1000 rpm and an overall gear ratio of 4.8:1. This ratio would be reduced to 2.5:1 if the engine were working at its optimum speed.

The latter condition being the ideal, let us assume that the engine is to run constantly at this speed except during idling periods. This speed ratio in the hydrostatic transmission may be taken as constant and equivalent to the back axle ratio of the conventional transmission. It is easily attained in

HYDROSTATIC DRIVE versus TORQUE CONVERTER

Simple—variable displacement pump, direct-connected to engine shaft, delivers fluid through control and distributing valves to 2 or 4 hydraulic motors mounted in the wheels.

Brakes—none required. Reversing motors gives positive braking power.

Engine speed—constant at optimum rpm for fuel efficiency.

Four-wheel drive—easily obtained.

Complex—transmission requires a friction clutch, gearbox, propeller shaft, differential, half-shafts and back-axle casing.

Brakes—required on all four wheels.

Engine speed—must vary to give power required. Motor cannot operate at optimum speed, so fuel cost is high.

Four-Wheel Drive—would add to cost and complexity.

the hydrostatic drive, by employing a pump whose maximum output at this speed is two-fifths the combined capacity of the driving wheel motors. In this respect it should be noted that two or four-wheel drives are equally easy to attain. The system is ideally suitable to the steering of driving wheels where the hydraulic motors are built into the wheels, the hydraulic supply being admitted through ports drilled in the stationary motor shafts. To date the application of four-wheel drive has been restricted to military vehicles, but there are indications that its use may become more widespread with the yearly increase in engine horsepower and the call for greater traction and safety.

• **Pumps and motors**—Fundamentally, the pump and motor drive in itself raises no serious problems. That the basic conception of this type drive is practical is proved by its application to other types of wheeled vehicles. The higher road speeds of automobiles naturally cause special consideration to be given to pump and motor design, but calculation will show that the speeds, fluid flow, horsepower, and pressures and stresses involved are all within the realm of engineering and metallurgical reality.

• **Control**—All that is theoretically required to initiate vehicle acceleration and deceleration is a single control lever or pedal to bring the engine from idling speed up to optimum running speed, at which a conventional governor takes command; and then to actuate the transmitter of a twin-pipe remote control system actuating the pump output control. Possibly a less costly direct mechanical linkage might be employed, but this has the defects of lack of flexibility, wear, backlash and the need for lubrication. By using a hydraulic control arrangement it is easy to suitably proportion the relative loads and travels of the transmitter and the receiver actuating the tilt angle control of a swashplate pump, or the track ring eccentricity of a variable delivery radial piston or vane pump.

The most elementary form of hydraulic control is shown in Figure 1. Perhaps the foremost difficulty this presents is that an entirely new driving technique is involved. The application of positive braking power to the moving vehicle consists of reversing the tilt angle of the swashplate, passing through the neutral position. This entails pulling back the control lever past the neutral position, whereas the motorist is accustomed to braking by actuating his brake pedal in the same direction as that used to produce acceleration. The new technique of driving would be akin to the ahead and astern control used in marine practice. By employing two levers this can be overcome mechanically. A primitive arrangement to do this is shown in Figure 2. It should be noted that the arrangement in Figure 1 takes the fullest advantage of the differential effect of the piston rod areas in the two elements. The result of this is to give increased sensitivity in braking

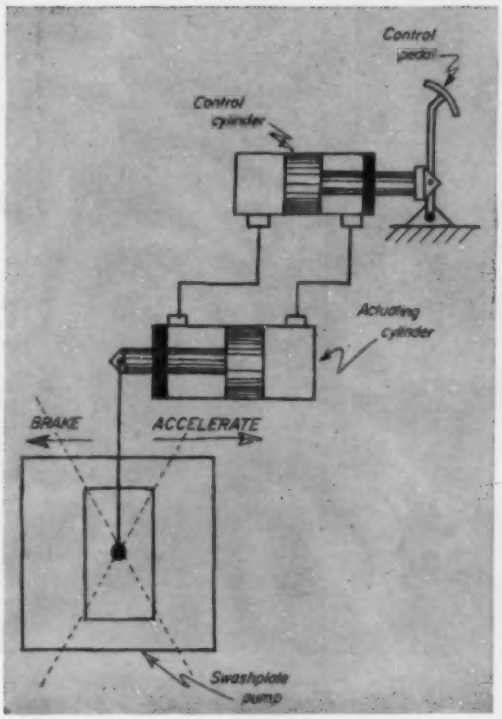

FIG. 1. CONTROL CYLINDER uses differential effect of piston and piston rod areas to actuate cylinder controlling tilt angle of swashplate pump.

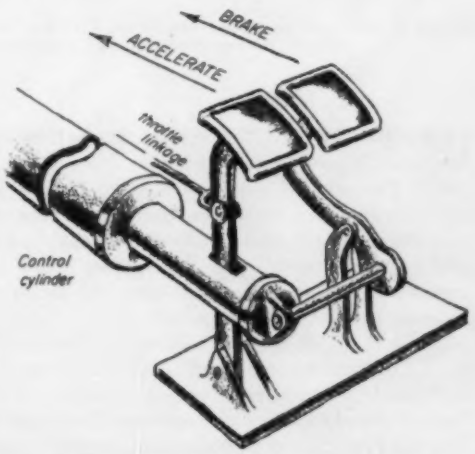

FIG. 2. TWO PEDALS give complete control of hydrostatic drive. On initial accelerator pedal movement, throttle linkage control brings engine from idle to optimum speed which remains constant.

and reversing for the same traverse of the transmitter piston as compared with acceleration. Such a mechanical linkage can obviously be refined and by suitable proportioning of the lever arms the optimum traverses and forces for accelerating and

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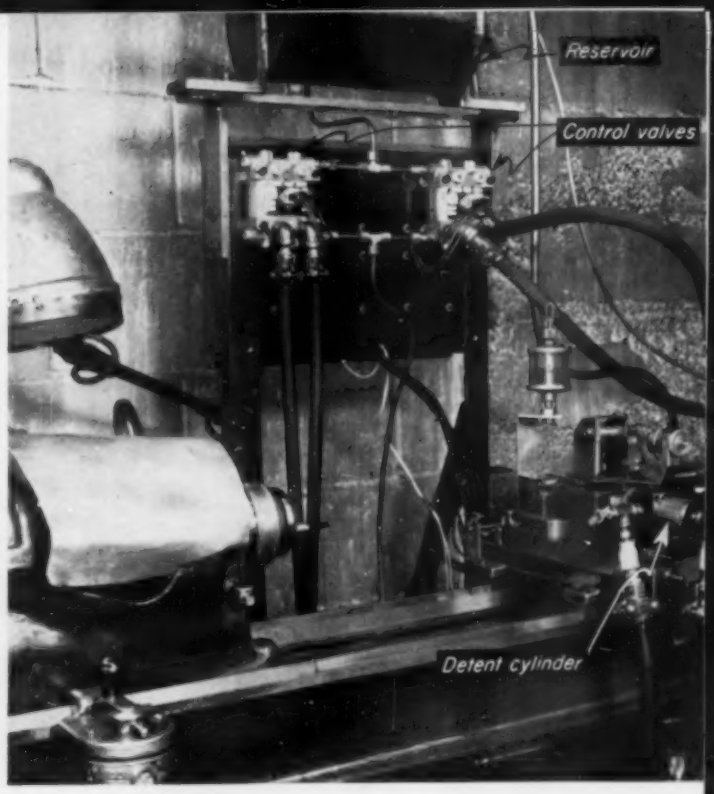
Designed for a special forming operation, this inexpensive machine employs unusual electrical control, with low-pressure hydraulic power.

• By William MacLeod and W. C. Nuckles



SHOP BUILT FORM TOOLING

. . . uses clever

IN designing tooling for in-plant production use, the most important yardstick is—"Does it do the job?" The engineer does not have to be a stylist and plan sweeping enclosures, modernistic cabinets, and smart controls and instruments. Many "not so pretty" machines actually incorporate much ingenious design thinking, and turn out precision, uniform products for many years.

The tool engineering department at United Aircraft Products was required to design a machine to form detent grooves in tubing. Accuracy of the formed indentation was an important consideration. The machine had to accommodate varying lengths of tubing and also be able to form the detent at variable locations.

Starting with a bench lathe bed, headstock, collet and drive unit, two cylinders were mounted: one to force the detent forming tool against the work, and the other to index the detent head from one position to the next.

Indexing the detent forming cylinder is accomplished by a specially designed collector rail consisting of copper conductor bars separated by lucite insulator bars. A brush which connects the electrical signal through this rail is mounted on the detent forming head and is machined .030 inch thinner than the lucite bar on which it stops. This insures a location accuracy of ± .015 inch.

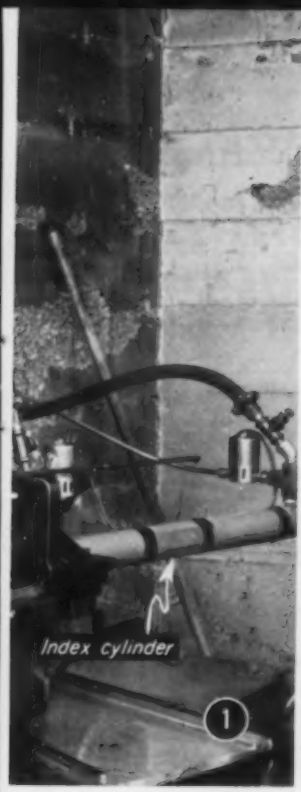
The depth of the indentation is controlled by a limit switch actuated by the detent forming cylinder at the end of its travel. This limit switch has an actuation accuracy of .005 inch and is tripped through a mechanical arrangement which increases the accuracy of the detent formation to .0005 inch at each station. The accuracy of the detent diameter is then .001 inch.

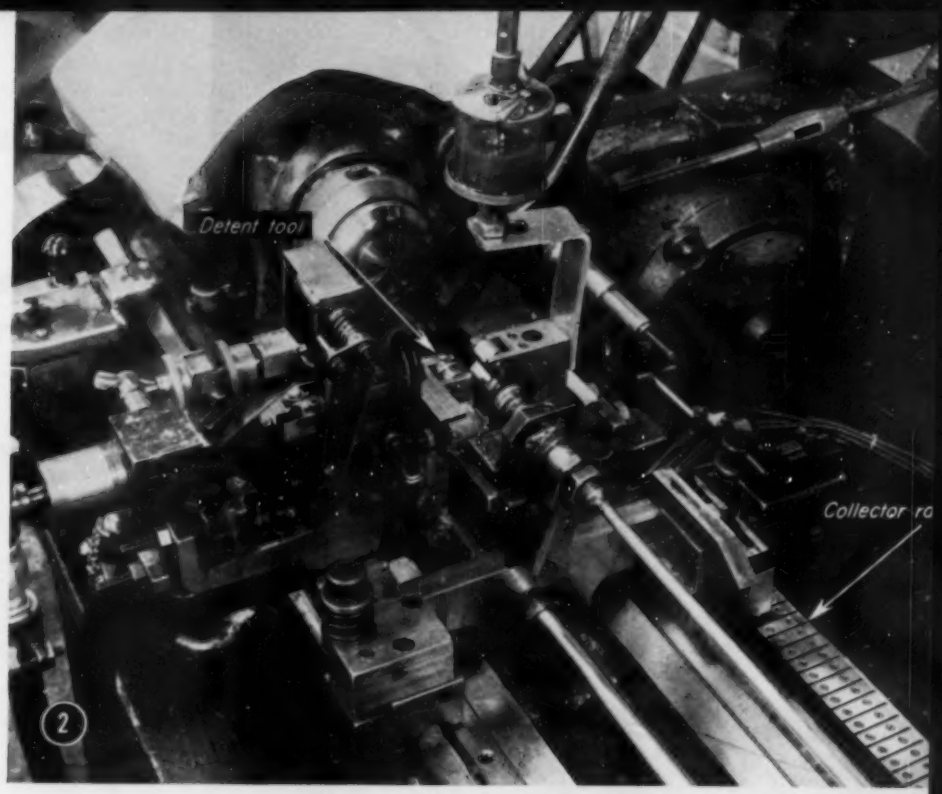
HYDRAULIC CIRCUIT

The vane type pump delivers ½ gpm at 200 psi and draws from a 1-gal cylindrical reservoir. The reservoir is mounted above all other components to prevent air from entering the hydraulic lines.

The system pressure is regulated by a pressure reducing valve set to 150 psi. This permits adjusting machine sensitivity to increase accuracy of posi-

WILLIAM MACLEOD, W. C. NUCKLES, *Tool Engineering Dept., United Aircraft Products, Inc., Dayton, Ohio.*





1. DESIGNED for a special forming operation this oil-powered tooling was added to a small lathe bed.

2. OPERATION of the detent tool is controlled by a limit switch. Form depth is held within .0005 inch. Collector rail controls lateral index position of the tool carriage.

3. ELEVEN electrical relays control the automatic cycling of this low-pressure oil circuit.

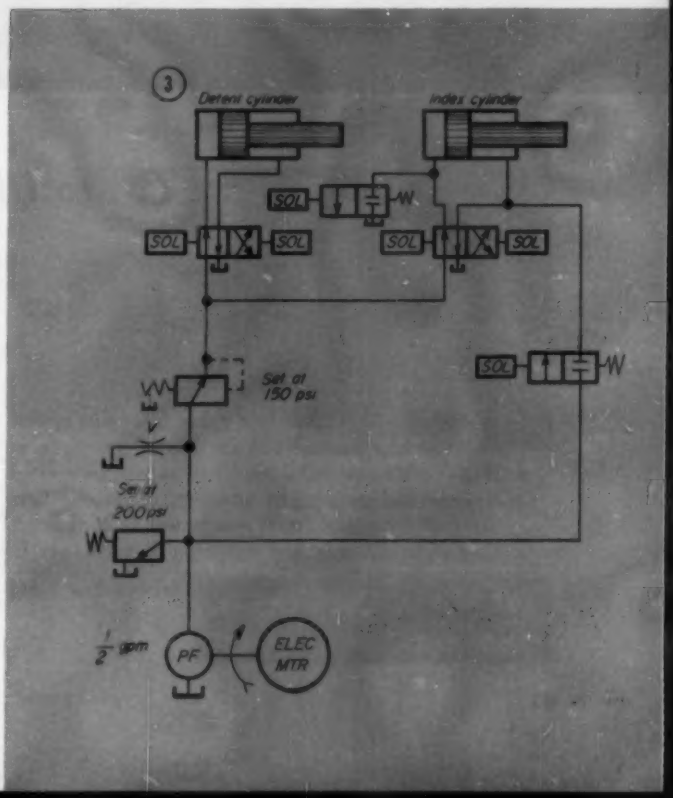
electrical control

tioning. Speed of the cylinders is regulated by a needle valve connected in a bleed-off circuit. The cylinders are controlled by two 4-way solenoid-operated valves. These poppet type valves are compact units and are installed on the electrical control box which also houses 11 relays.

OPERATION

After the operator loads the pre-cut stock, he presses the START switch to initiate automatic operation of the machine. The indexing cylinder positions the carriage to each station controlled by the collector. The detent forming cylinder then performs its operation, after which the indexing cylinder again extends.

At the end of the cycle, two 2-way solenoid valves are actuated for a fast return of the indexing cylinder. The maximum speed of the machine is 32 operations over a tube length of 14 inches in 50 seconds including return to initial position. During a two month period the machine operated continuously 16 hours each working day. The only maintenance required was the replacement of one electrical switch and normal tool maintenance. ▼▼▼



Can large, heavy exhibits be moved efficiently in and out of a multi-story building? The answer is found in the . . .

LOW PRESSURE HYDRAULIC ELEVATOR

. . . to lift 75,000 pounds 62 feet

• By J. B. Harrison

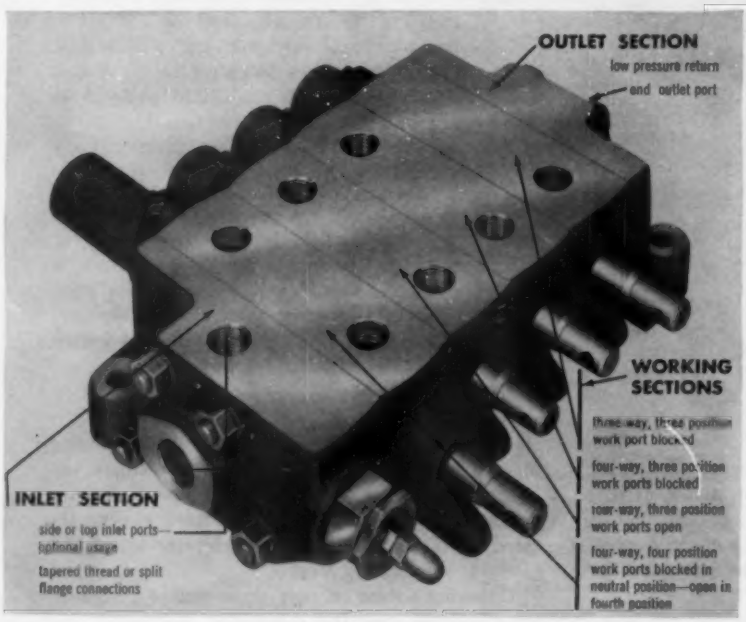
A 260 psi, 1060 gpm, four pump hydraulic system helps manufacturers who display products at New York's new exhibition hall to obtain savings in time and money. In addition, dangerous handling of large and heavy equipment is eliminated. Cost of bringing in and removing displays may be reduced as much as 50 percent by this hydraulic elevator, designed and built by the Rotary Lift Company.

J. B. HARRISON, *Vice President—Engineering, Rotary Life Company*

• **Service**—When necessary, a fully-loaded highway carrier can be driven into the elevator and raised to any of the four floor levels. Normally, a truck is backed up to the front edge of a lift, which is also hydraulically operated. Both the lift

size for size...

Commercials Oil Hydraulic Valves
give Original Equipment Manufacturers up to 25% more gpm capacity


OUTLET SECTION
low pressure return
and outlet port
WORKING SECTIONS
three-way, three position work port blocked
four-way, three position work ports blocked
four-way, three position work ports open
four-way, four position work ports blocked in neutral position—open in fourth position
INLET SECTION
side or top inlet ports—optional usage
tapered thread or split flange connections

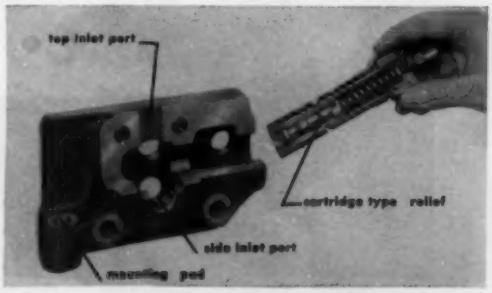
Available in three sizes, you will find these new "B" series valves have higher performance ratings than other valves. To assist you in selecting the size best suited for your application, data is available to show their internal pressure drop for different volumes of flow under varying operating pressures as encountered in actual operation.

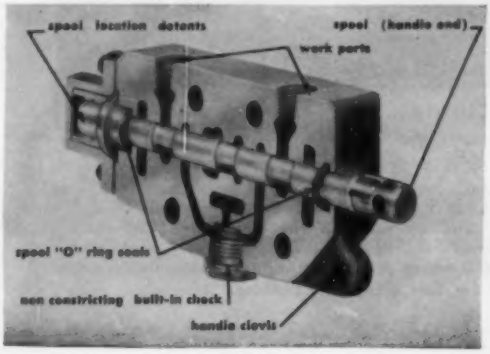
Every working section of these new valves has its individual built-in check which blocks against all return flow until the return pressure is overcome by pressure build up from the pump. This means that irrespective of the number of working sections which may be in operating position no load drop can occur. Danger resulting from erratic operation or one load dropping while another is being positioned is eliminated. Not even the slightest pre-lift drop can occur as a load is being positioned.

Other important new features have been incorporated in these new valves which reduce their internal pressure loss. Internal passageways are larger, of more uniform cross section, free from abrupt change of direction and have smoother wall surfaces. Spools are solid and without internal restriction. Thus constriction to flow inside these valves is less than other valves and their pressure drop has been improved as much as 25%. All sealing between sections and at ends of spools is by O-rings instead of gaskets, so now you can use these valves at working pressures up to 2000 psi and have trouble free, leak proof operation with the timing action so exact and precise that "inching" loads to exact position is a stable operation.

Safety protection for the hydraulic system, plus overload protection for the structural members and tools of the machine in operation, are provided by a new combination overload relief-pressure control valve. It is built into a complete cartridge and is easily removed as a unit from the inlet section of the valve bank. Thus inspection of this important sentinel is easy and replacement can be accomplished in a matter of minutes.

inlet section
Cartridge overload relief
2000 psi pressure





working section
3 sizes—10 to 65 gpm
Multiple section,
parallel circuit

Write to Dept. A-10, The Commercial Shearing and Stamping Company, Youngstown, Ohio; Chicago, Illinois; Salt Lake City, Utah.

COMMERCIAL
shearing and stamping

and the elevator are raised to the level of the truck or trailer bed. This provides a level plane from truck bed right into the elevator car.

• **Protection**—Hydraulic system is designed for smooth starts and stops using a special controlling device, with pressure differential valves operating on pressure within the system. Valves are opened and closed in a controlled manner. No shock is transmitted to any part of the system. Controller is one complete unit, including shut-off valve, check valve, reljef valve, bypass valve, and lowering and leveling valves. Each of the four elevator power unit pumps has its own controller.

• **Ascent**—Elevator is actuated by momentary pressure push button stations in the car and at each of the six landings it serves. Depressing a push button starts one of the four elevator motor-pump units. The other three motors start in stages, with a lapse of about two seconds between each to avoid a too-heavy current in-rush. These starts are carefully timed and acceleration is constant and smooth.

• **Controller operation** is the "heart" of the hydraulic system. Each controller begins functioning immediately with the start of its motor. It bypasses full initial output of the pump until motor and pump have reached full rpm. Then the bypass valve slowly closes, diverting oil into the system to raise the elevator.

When in full up-travel, all four pumps are operating. Just before the car reaches the landing at which it is to stop, it contacts a limit switch which cuts off three pumps, decreasing car speed. Any one motor-pump unit is capable of raising and supporting the elevator. Four units are used to provide the desired speed.

As the car continues toward the landing, a cam-controlled leveling switch gradually opens a bypass valve in the controller on the one pump still operating. Oil is diverted from the jack, the car decelerates further and stops level with the landing floor. Check valves in the controllers are closed and the elevator rests on a locked column of oil.

Unloading or bypass valve is timed to open fully when the pump decelerates, stopping the car at that point and bypassing additional fluid pumped as motor and pump spin from momentum.

An automatic releveling device operates if the car drifts from landing level. The releveler starts one motor and pump to bring the car back to its proper level.

• **Descent**—Gravity brings the elevator down at controlled speed. The elevator push button energizes the coil of a lowering pilot valve in the controller. System pressure opens a hydraulic lowering piston, permitting oil to bypass the check valve and return to reservoir.

Stops on descent are also a two-stage procedure. As the descending elevator approaches the landing at which it is to stop, a limit switch closes two lowering valves, reducing elevator speed. A cam-operated leveling switch then operates, closing the third lowering valve, and the elevator stops precisely at the landing level.

Lowering valves on only three pumps give sufficient control over the downward movement, and all three valves open simultaneously when a "down" button is pushed. ▼▼▼

FOUR ROTARY PISTON hydraulic pumps, driven at 700 rpm by individual 50 hp motors, supply oil at 260 psi. Maximum pump capacity is 1060 gpm and system holds 3000 gallons of fluid. Combined supply and return line is 6-inch diameter pipe.

HYDRAULICS will save exhibitors thousands of dollars in handling costs in the New York Coliseum. This 4-level exhibition hall uses three hydraulically-operated loading platforms and the huge hydraulic elevator for fast efficient handling.

APPLIED HYDRAULICS

PNEUMATIC APPLICATION ARTICLE

Using mostly surplus and salvaged parts, this pneumatic application quickly paid for itself. Production was increased 400 percent and labor reduced 75 percent by this simple circuit working at 80 psi off the ordinary shop air line.

VERTICAL AIR CYLINDERS have lowered the filling nozzles down into the empty bottles. Five nozzles were blanked off as air operation stepped up output beyond capacity of present capping and labelling machine. Filled bottles at left have been pushed onto the conveyor belt by the horizontal air cylinders located at the rear of the machine.

AIR POWER

. . . improves bottling operation

• By John A. Lankester
European Editor, APPLIED HYDRAULICS

INHERENT advantages of pneumatics for precision production jobs are clearly illustrated in this cosmetic bottling operation. Displaying lots of ingenuity in using inexpensive components, the staff at County Laboratories Ltd. London, England, built the installation in a very short time. Except for the pneumatic equipment, most of the components and electrical gear used was surplus or salvaged equipment.

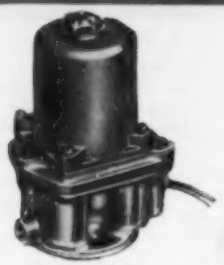
Working with pronounced efficiency, this system very quickly repaid the cost of construction. In fact, the bottling operation was made so efficient through the use of air power that the labelling and capping operation could not keep up with the pace. Several filling nozzles had to be blanked off temporarily until faster labelling and capping machines could be installed to handle the increased output.

• **Pneumatics:** A pair of air cylinders are mounted horizontally, at right angles to the incoming conveyor belt. These cylinders move empty bottles, ten at a time, onto a dead plate beneath the filling nozzles. Three air cylinders are mounted vertically

Ross air control

long

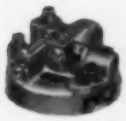
WHITE STAR
SPOOL SOLENOID



GOLD STAR
OIL-IMMERSED SOLENOID

BLUE STAR MV

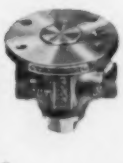
BLUE STAR TD



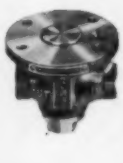
BLUE STAR WV

match any head

STRAIGHTWAY
NORMALLY
CLOSED



STRAIGHTWAY
NORMALLY
OPEN



Tests indicate a trouble-free life of over 25 million cycles for valves with the spool solenoid pilot section, and *more than 40 million for all other Starline* valves shown. Heads and bodies are completely and instantly interchangeable. Sizes from ¼" to 1¼". Even *more* Starline models coming later. Write for Starline data file.

Ross

Starline

valve series

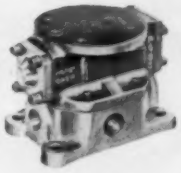
life

to any valve body!

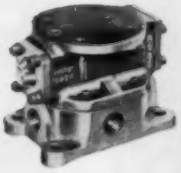
3 WAY NORMALLY OPEN

3 WAY NORMALLY CLOSED

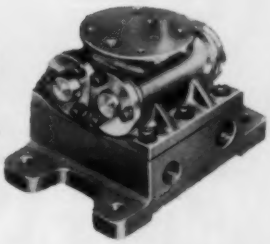
3 WAY NORMALLY OPEN



3 WAY NORMALLY CLOSED



4 WAY



A Galaxy of New Air-Control Stars Are Coming Your Way From

OPERATING VALVE COMPANY

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Circle 138 on Reader Service Card

above the filler nozzle mounting plate, raising and lowering the nozzles into the bottles. When the bottles have been filled and the nozzles withdrawn, the pair of horizontal air cylinders moves another set of empty bottles into position, which pushes the filled bottles onto the conveyor belt going to the labelling and capping machines.

• **Sequence:** One conveyor belt carries empty bottles to the filling machine and a parallel conveyor takes the filled bottles to the capping and labelling machine. Empties move past a photo-electric cell, actuating a pawl and ratchet wheel assembly, which closes contacts on a rotary switch after 10 bottles have passed. These contacts energize a solenoid control valve which directs compressed air to the pair of horizontal cylinders, causing them to extend.

This action displaces the 10 bottles from the conveyor belt onto the dead plate beneath the filling nozzles. Full extension of these rams trips a limit switch, de-energizing their solenoid valve, reversing their direction of travel and withdrawing the pusher plate to its original position. Another limit switch is so located that when the pusher rams are fully withdrawn, a second solenoid valve directs compressed air to extend three vertical cylinders positioned above the filler nozzle mounting plate.

Once the nozzles are firmly pressed down on to the necks of the bottles, a vacuum circuit is sealed, air is exhausted from the empties, causing the shampoo preparation to be drawn into them from the stock tank via flexible hose lines. This portion of the cycle is controlled by an electrical timer, adjusted so that all bottles are filled to the correct level before the circuit resumes operation.

When the filling operation has been completed, the timer actuates the solenoid control valve of the three vertical cylinders, raising the filler nozzles.

Benefits From Air-Operation

1. **Speed**—Formerly 48 bottles of a shampoo preparation were filled per minute. The output has now been raised to 200 bottles per minute—an increase of 400 percent. Bottles are filled to correct level in about 2-½ seconds.

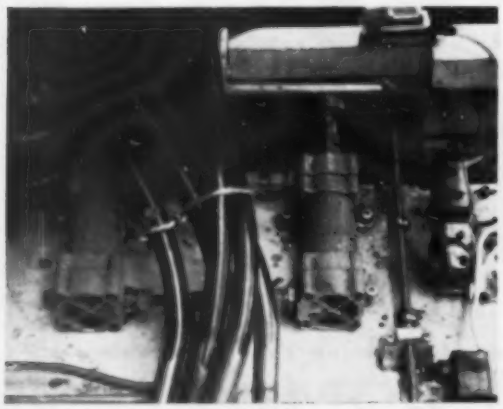
2. **Accuracy**—Air cylinders position bottles and filler nozzles exactly. Automatic, vacuum-operated filler nozzles can be set with great accuracy to provide uniform level of fill and prevent waste due to spilling or overflow. Thus cleanliness of the operation has also improved.

3. **Labor-saving**—Previously four operators were required. Now, one operator produces four times as much and his only job is to remove empty bottles from their cartons and place them on the conveyor belt. As filling is automatic, operator's attention is no longer necessary.

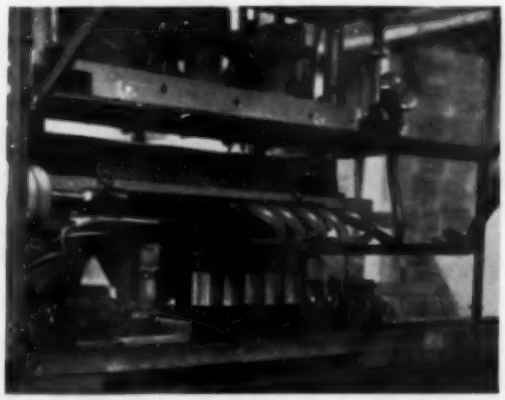
At this point another interlock switch activates the horizontal pusher rams once again to bring forward the next 10 empty bottles, which have meanwhile been marshalled by the incoming conveyor. Forward movement of the empties pushes the 10 filled bottles off the dead plate and onto the outgoing conveyor.

If the rate of filling exceeds the rate at which the bottles can be handled by the capping and labelling machine, a limit switch cuts off the circuit and stops the machine until the backlog is worked off by the capping and labelling machine. ▼▼▼

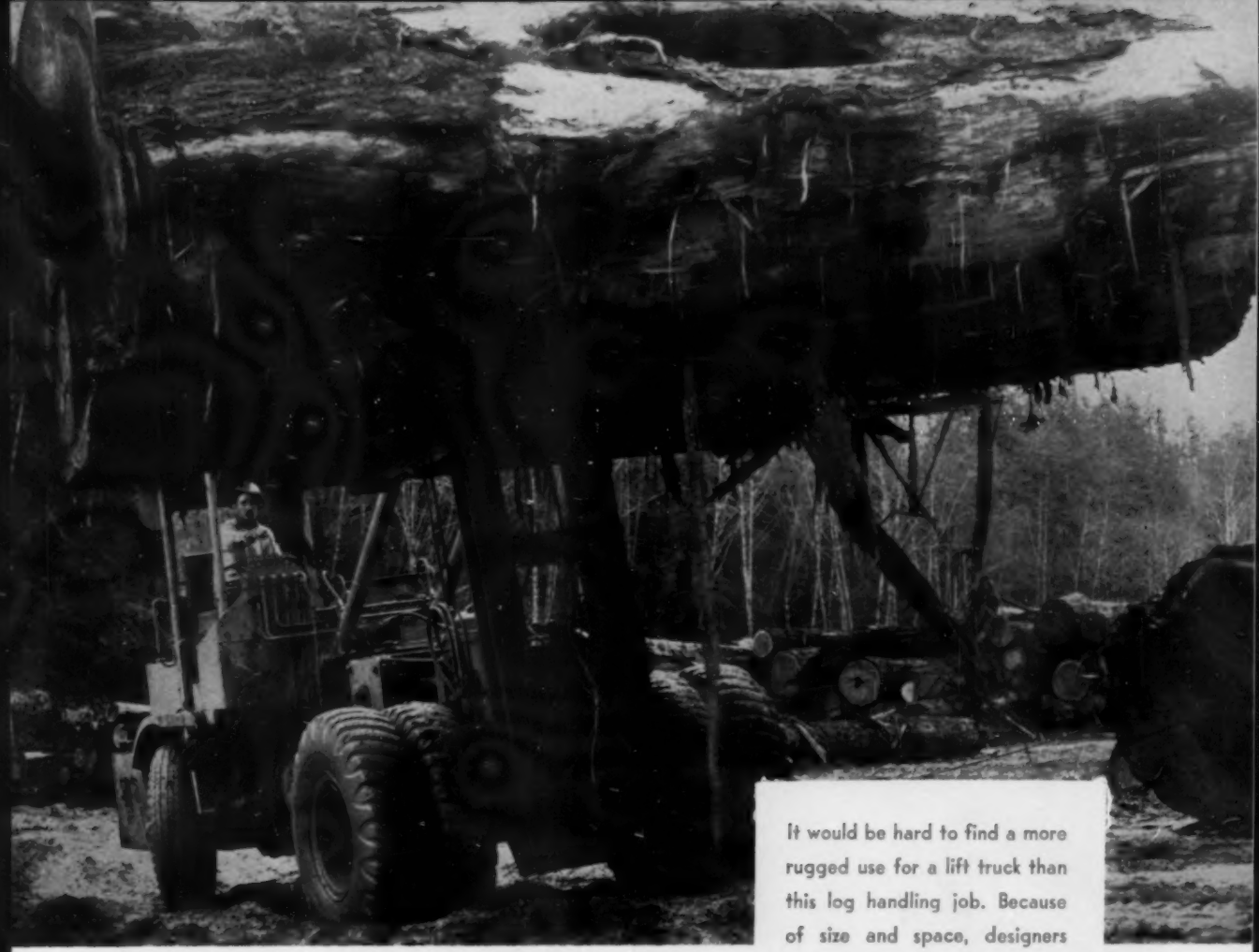
Photos and pneumatic information courtesy of Baldwin Instruments Co. Ltd.



HORIZONTAL AIR CYLINDERS are shown ready to extend and push empty bottles onto the dead plate below the filler nozzles. The shampoo comes from the stock tank through the flexible plastic pipes.



FILLED BOTTLES at left are holding up the machine until labelling and capping machine catches up. Glass door at front of machine is open, and in this position a safety interlock cuts off the system.



It would be hard to find a more rugged use for a lift truck than this log handling job. Because of size and space, designers went to a system which has the relief valve set at 5000 psi.

HIGH-PRESSURE HYDRAULICS

. . . serve the lumber industry

• By Heinz Nowak

IN DESIGNING the hydraulic system for this new unit to secure utmost maneuverability, space was at a premium. A load of 25 tons was to be handled at a speed of 17 feet per minute and thrust loads were expected to approach 225,000 pounds. It was not practical to mount a standard 1000 psi system on a truck, due to its size.

The obvious approach was the use of high pressure pumps and valves with their relatively small volume and small diameter connecting media. In this system a 10 gpm pump is combined with a 4-section stackvalve. The pump operates at 1000 to 6000 psi, with speed variable from 800 to 1800 rpm, and maximum input of 41 horsepower. The stackvalve is series type, open center, three position, double acting, with integral relief valve. The load is always under complete control.

HEINZ NOWAK, *Hydraulic Air Equipment Company, Portland, Oregon*

HIGH PRESSURE HYDRAULICS

Two 4 inch by 59 inch stroke cylinders are incorporated into the system to permit a 30 degree forward and a 150 degree backward tilt. The design of these tilt cylinders was critical as they must secure the two legs of the tower at any angle. They must also be rugged enough to withstand the extreme shock loads when the front forks are used to split the redwood logs in two.

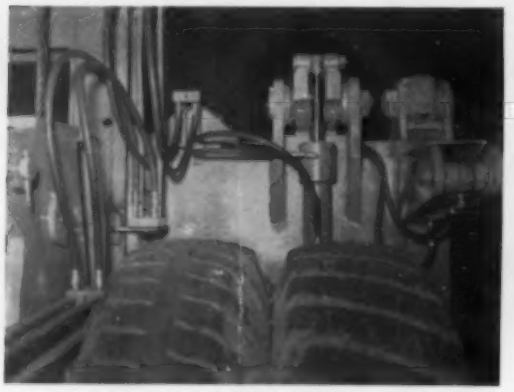
While the log is on the forks and in transit, it is securely held by two hydraulically-operated dogs clamping down on it. These dogs are 66 inches long and are operated by cylinders of 3 inch bore and 10 inch stroke. When the log is dumped, the opening of the dogs also operates the two kick-off arms to remove the load from the forks.

The mast is 18 feet long and carriage travel is critical considering the load to be balanced. On this unit the carriage travels at 17.33 feet per minute which is more than sufficient for stability.

Through the use of high-pressure hydraulics all of the major portions of the components are grouped within an eight foot area. All piping was done with $\frac{5}{8}$ inch seamless steel tubing, and the flexible lines are of $\frac{3}{8}$ inch hose and fittings.

Creating this new piece of equipment required a little mechanical crossbreeding. The result is an adaptation of the fork truck idea, with the fork unit mounted on a truck chassis powered by a 150 horsepower diesel engine. Forty-five horsepower is used to power the hydraulic system when operated under full load. The high pressure hydraulic pump is coupled directly to the crankshaft extension. A crosshead and multiplier cable operates the fork lift.

This newly designed "brute" is speedy and highly maneuverable. Two operators and one bucker now relieve six men for other duties. This application illustrates high-pressure hydraulic equipment for industrial use engineered to stand up under severe service conditions. ▼▼▼



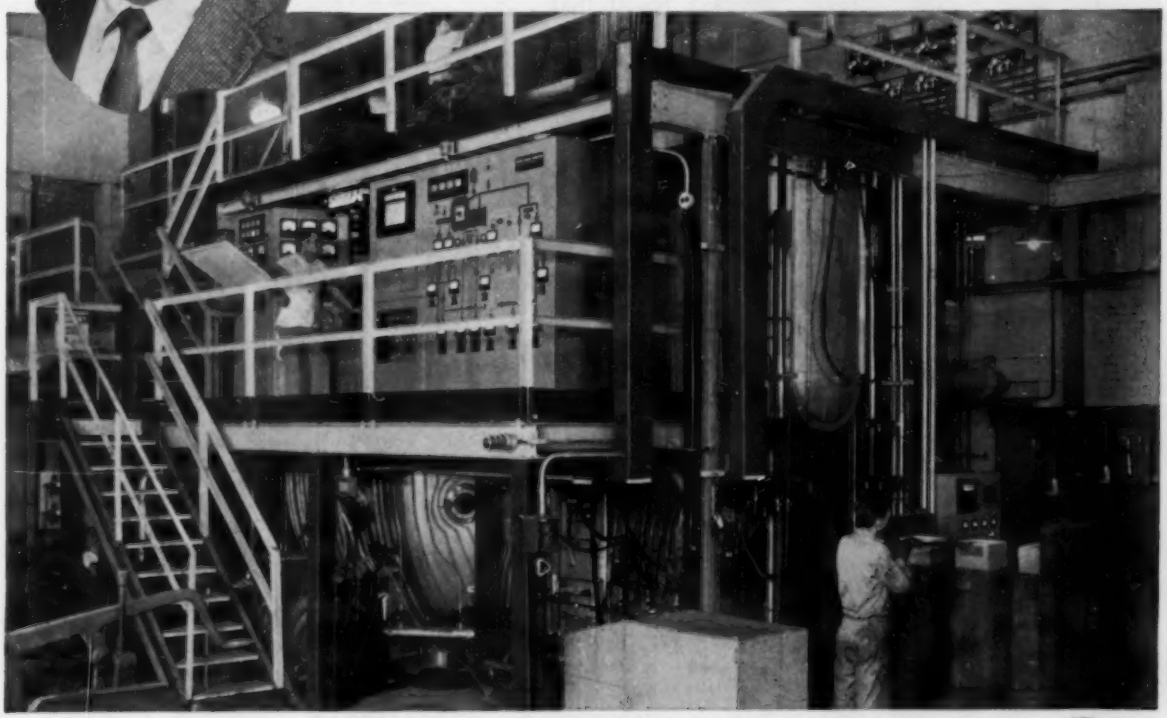
DOUBLE ACTING cylinders with 3-inch bore and 10-inch stroke operate clamp dogs. Tubing is $\frac{5}{8}$-inch stainless and flexible lines are $\frac{3}{8}$-inch.

TILT CYLINDERS secure 18-foot mast at any angle and withstand extreme shock loads. Also shown are clamp dogs and kicker bars.

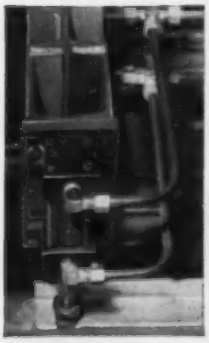
CLAMP DOGS hold load secure during travel. Tilt cylinders permit 30-degree forward and 150-degree backward tilt.

"Our experience demonstrated that hydraulic line rupture can occur in proximity to molten metal without fire when Cellulubes are used . . ."

Mr. Arthur E. Franks of Vacuum Metals Corporation, Syracuse, N.Y.



***". . . this is why* fire-resistant Celanese Cellulube hydraulic fluid is in use in the world's largest vacuum furnace at Vacuum Metals Corporation."**



Hydraulic Controls on the world's largest vacuum furnace

In designing the hydraulic controls for its 2500-pound vacuum melting furnace, Vacuum Metals selected Cellulube hydraulic fluid because of its fire resistance and low vapor pressure characteristics. Laboratory tests and operating experience demonstrated that the unique combination of Cellulubes' properties made it the ideal material for this application.

These findings are typical of Cellulubes' performance during continuous operation under critical conditions. As hydraulic fluids, Cellulubes reduce the dangers of fires and explosions caused by line breaks or other equipment failures. As air cylinder lubricants, Cellulubes prevent the formation of excessive carbon deposits—the main source of compressor fires and explosions.

Available in 6 controlled viscosities, Cellulubes can be supplied to meet exacting requirements in the replacement of flammable fluids presently in use. Play it safe, write for complete data and technical assistance. Celanese Corporation of America, Chemical Division, Dept. 588-C, 180 Madison Ave., N. Y. 16.

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CHEMICALS

Chrysler's Mound Road V-8 Engine Plant in Detroit can turn out 1200 engines every eight hours. This high rate of production emphasizes the need for good maintenance procedures. Headed by H. Schocker, the machine repair department in this division is responsible for the testing and repair of hydraulic components and circuits. Installation of "up to specs" components saves time and money. They have found that . .

IN-PLANT COMPONENT TESTING

. . . adds reliability to hydraulic operation

• By A. J. Phillips

COMPONENTS that are in proper working order when installed cut hydraulic downtime. This is very essential to maintain the production output of automation equipment. The hydraulic test stand used at the Mound Road Engine plant has proven very valuable in diagnosing hydraulic trouble and checking internal and external leakage of valves and cylinders.

Originally designed for testing one manufacturer's hydraulic valves and piston pump closed-feed circuits, this equipment has been adapted to test four other lines of gasket mounted valves by the use of suitable subplates. For greater versatility in testing the variety of components used in this plant, external ports have been provided. Using

A. J. PHILLIPS, *Supervisor, Hydraulic Tool Trouble, Mound Road V-8 Engine Plant, Engine Division, Chrysler Corporation, Detroit, Mich.*

VALVES and cylinders and some piston pumps used for replacement on equipment in the Plymouth engine plant are tested before installation.
Courtesy John S. Barnes Corp.

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Regd Trade Mark

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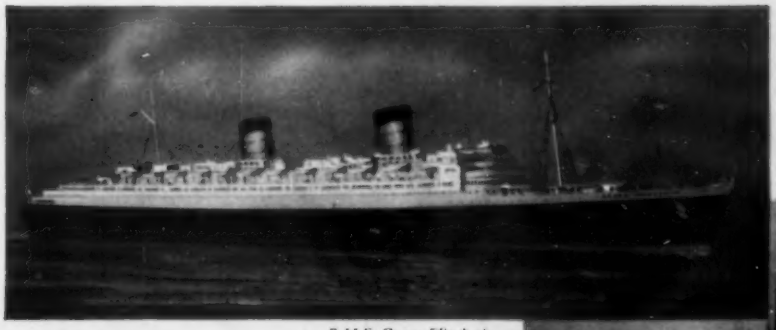
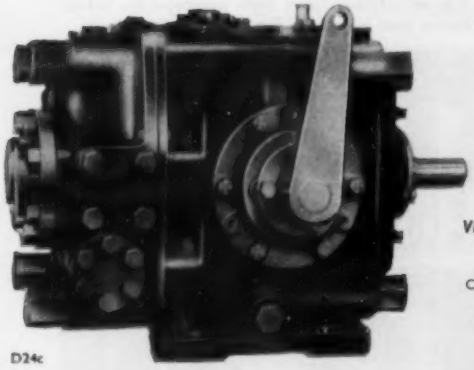


R.M.S. Queen Elizabeth

"DENNY-BROWN" STABILISERS

Yet another example of the highly varied operations to which 'VSG' hydraulic pumps are applied is provided by the Denny-Brown stabilisers fitted to many vessels, including R.M.S. Queen Elizabeth. The 'VSG' pumps are incorporated in the mechanism for actuating each of the four fins.

One of the two port fins of the Queen Elizabeth Ship Stabiliser



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flexible hose, cylinders and threaded connection valves are connected to these ports for testing.

BUILT FOR PROMPT SERVICE

The test table has two master manifolds for the installation of gasket mounted valves to be tested. Blocking plates are supplied to block master manifolds when they are not in use. A sliding guide bar with control dogs, for operation of cam operated valves and limit switches, is mounted on top of the table and is operated by a 3-½ inch bore x 12 inch stroke cylinder, which is mounted underneath the table. Each port of the guide bar cylinder has a shut-off valve to isolate it from the circuit when another cylinder is being tested. Any oil spillage on the table is drained through a filter into a scavenger tank, which is located in the cabinet beneath the table. This tank can be removed through the front door of the cabinet for cleaning.

A 1-hp 1200 rpm motor is mounted in the cabinet and connected to the piston pump drive housing by a V-belt. This housing is located on the right side of the panel. No adaptor is required to mount the piston pump. The face of the housing is machined so that it is only necessary to line up mounting holes for the various types of piston pumps. The charge and discharge ports of the pump are connected to the panel with flexible hose.

The main pumping unit is also mounted in this cabinet. It consists of a duplex constant delivery vane type pump and a duplex gear type pump. They are driven by a 10 hp 4-speed electric motor (600, 900, 1200 and 1800 rpm).

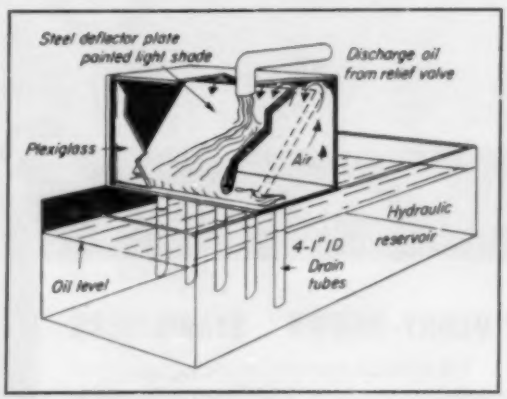
A flow meter of 0-30 gpm is installed on the panel and connected into the intake line of the pumping unit, where it is protected from a build up of pressure. A series of manually operated bypass valves, installed on the panel, and in-line check valves are arranged so that oil flow from any pump can be bypassed from the main pressure header back to the outlet of the flow meter. In this way the flow meter is able to register the exact quantity of oil being used.

Conventiently located on the control panel are: gauges for main header pressure, back pressure piston pump charge and piston pump discharge pressures; a pushbutton station; a solenoid connector with leads; a manually operated and/or automatic selector switch and voltage selector switch; a manual shut-off valve for pressure header to master manifolds; manual shut-off valve for the return line to tank from master manifolds, which is also used to build up back pressure; and manual controls for adjustment of relief valve settings.

The 30 gallon hydraulic reservoir is mounted on top of the panel, and all discharge oil from relief valves is directed through a flow observation box, attached to the top of this reservoir, before going to the tank.

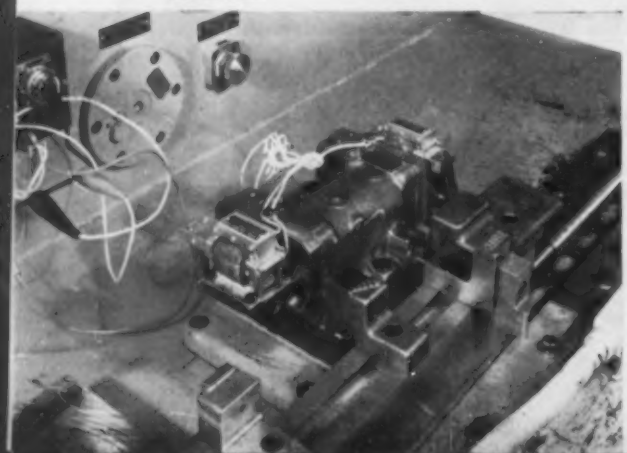
This flow box is constructed of steel with a plexiglas front. Separate relief valve discharge lines are connected to the top of this box and the operator can tell by the oil flow which pumps are in use.

All valves and cylinders used for replacement on equipment in this engine plant are checked on this equipment before installation. This procedure plays an important part in assuring reliable operation with mimimum downtime. ▼▼▼

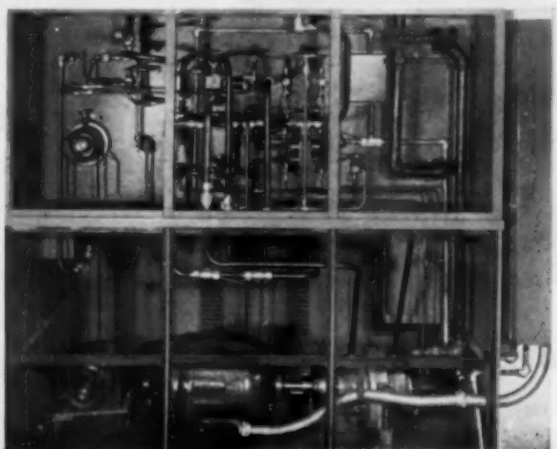


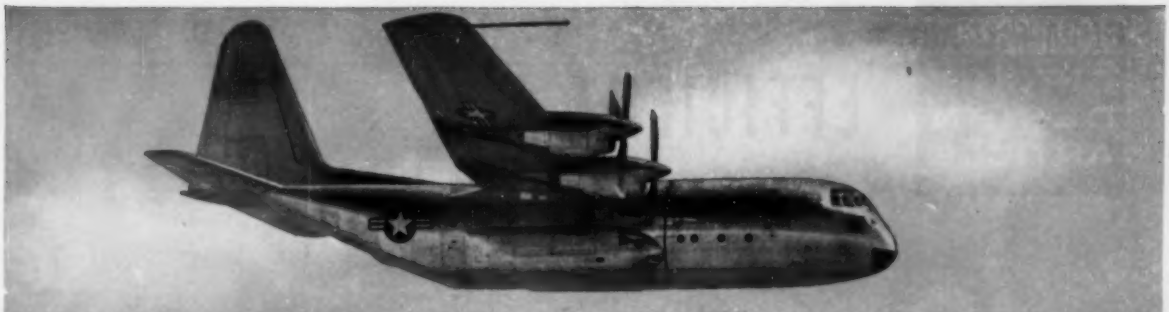
FLOW BOX is mounted above oil reservoir. All discharge oil from relief valves goes into this box. Through its plexiglas front, the operator can see by the oil flow, which pumps are in use.

GASKET MOUNTED CONTROL valves can be quickly fastened to a master manifold and checked. By use of suitable subplates, five different makes of valves used in this plant can be tested.



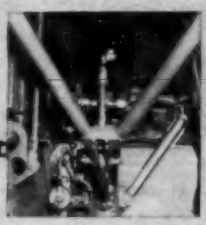
POWER UNITS for the test tables are located within the cabinet. On the left is a 1-hp motor which is connected through a V-belt to the test pump drive housing. The main pumping unit for supplying fluid and pressure to valves and cylinders under test is driven by a 10-hp motor.





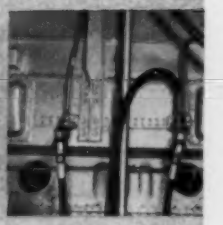
LOCKHEED ELIMINATES TIGHT BEND RADII

WITH CHIKSAN SWIVEL JOINTS



Installed on the nose wheel assembly of the P2V-7, Chiksan Swivel Joints eliminate tight radii bend in rubber hose.

Chiksan Swivel Joints on landing gear of Lockheed's Constellations give metal hydraulic lines the flexibility of rubber.



Located in the landing gear housing of the C-130 these Chiksan Swivel Joints conserve system space, lengthen hose life.

"Better check with Chiksan." That phrase is almost a byword with Lockheed design engineers when the problem of tight bend radii develops. For good reason, too. Lockheed engineers have found time and again that Chiksan has the experience and the facilities to provide a compact lightweight swivel joint to meet their needs quickly, efficiently. Check with Chiksan. Remember that phrase the next time you want a fast, right answer to your bend radii problem.

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APPLIED HYDRAULICS
CIRCUIT DESIGN ARTICLE

EFFICIENT FLUID MOTOR CONTROL ..... *for positive and negative work loads*

● By John R. Fawcett

THIS meter-out circuit is intended for motors driving positive loads and which may be subjected to negative loads. For example, lowering weights, or slowing down a machine with high inertia. Motor shaft speed is set by the flow control valve and a special pressure compensator valve varies the pump pressure to meet the demands of the positive load. If the load becomes negative, a brake valve prevents rising speed. The 4-way valve allows the motor to be reversed after it has been stopped by shutting the flow control valve.

Basic Hydraulics

As every high school physics student knows, efficiency of a machine is equal to the power output divided by the power input. In the case of a hydraulic machine, the "power out" is equal to the rate at which the machine moves (F) times the work load (L). "Power in" is equal to the pump pressure (P) times the pump capacity (Q). Putting this into an equation:

$$\text{Efficiency } (\%) = \frac{FL}{PQ}\ 100$$

On most machines where a fixed displacement pump supplies oil to a rotary motor, it is desirable to keep constant the rate at which the motor shaft turns regardless of changing loads. With the feed rate F constant and the load L varying, in order to maintain maximum efficiency, pump pressure must be made to vary directly with the load rather than remain at some constant value determined by maximum load.

Motor speed is controlled under all loading conditions, short of overload, by the flow control valve opening. The special brake valve acts as a pressure compensator for the flow control valve on negative loads—when the motor is tending to run faster than the set speed. If an ordinary relief valve were used instead, it could only slow the motor down to a stop. It would not be able to control the speed, a function the brake is specially designed to do.

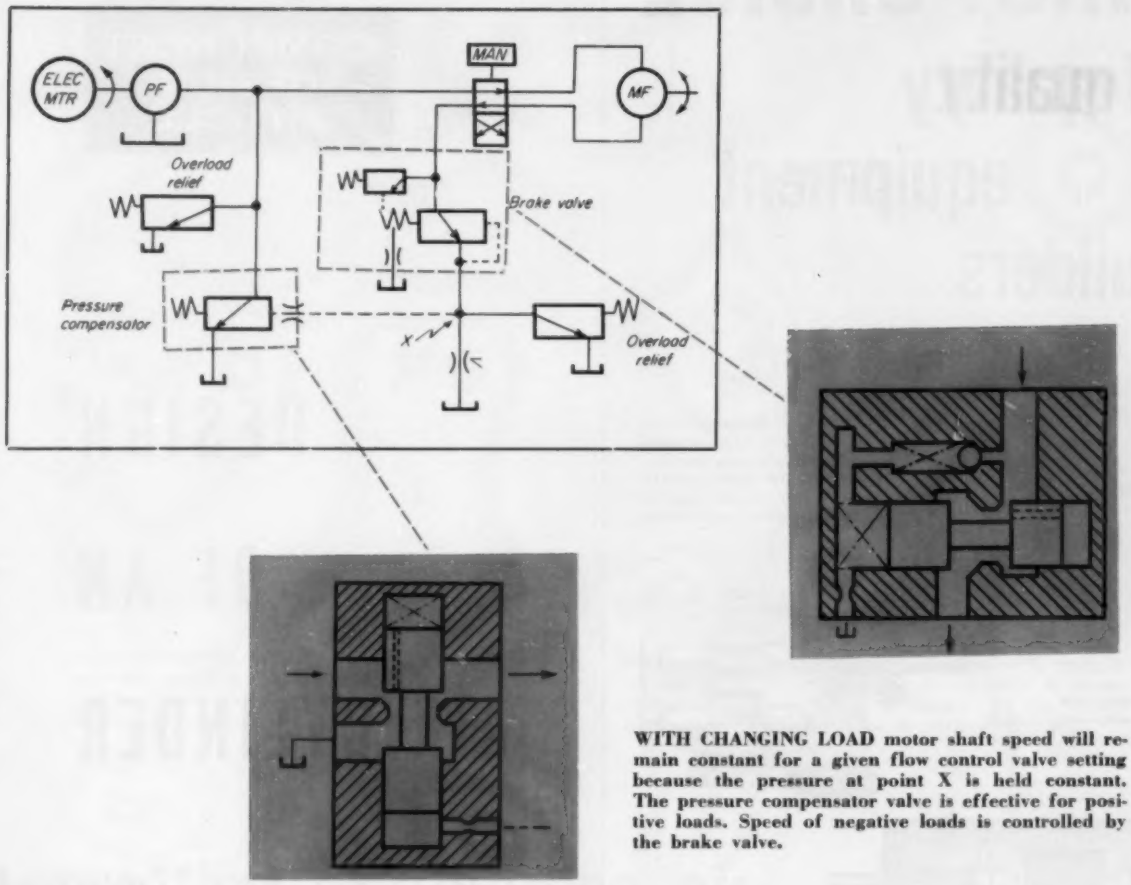
Both pump and motor are of the fixed capacity type and the motor speed is varied by the flow control valve. In the normal meter-out circuit, the pump operates at full relief valve pressure continously, but with this arrangement, the compensator valve maintains the pump pressure only at a level sufficient to overcome the load on the motor. Result is reduced power consumption and reduced operating temperature of the oil.

OPERATION WITH POSITIVE LOADS

The compensator valve is designed to fit into the pipe line. The spool has two main parts connected by a comparatively narrow neck. The upper part has a conical seat and regulates discharge of excess oil. It is balanced by a passage drilled through it. The control pressure entering at the bottom is opposed only by the spring above the valve spool. All other faces are at zero pressure. The spring keeps the pressure at point X in the circuit close to 30 psi by varying the discharge. Too high pressure opens the valve slightly and too low a pressure closes it.

If the motor is running light and assuming there is a fluid resistance, the pressure drop through the

JOHN R. FAWCETT, *Consulting Engineer, Timperley, Cheshire, England*



WITH CHANGING LOAD motor shaft speed will remain constant for a given flow control valve setting because the pressure at point X is held constant. The pressure compensator valve is effective for positive loads. Speed of negative loads is controlled by the brake valve.

motor will be zero and the pressure at point X will rise sufficiently to overcome the compensator valve spring holding the valve open to release surplus pump output to drain. This gives pressure compensation for the flow control valve because the compensator valve keeps point X at a constant pressure and pressure at the flow valve outlet is zero. When the motor is placed on load, let's say resistance rises to 100 psi and with the pressure at point X of 30 psi the pump discharge pressure will automatically rise to meet the load required, i. e., to 130 psi. Similarly, if the motor is loaded to the equivalent of 200 psi, the compensator valve blows off at 230 psi. For all positive loads below overload, speed is controlled and maximum efficiency is obtained.

OPERATION WITH NEGATIVE LOADS

The brake valve comes into action when the motor starts to act as a pump. This happens if the flow control valve opening is reduced when driving a machine with high inertia or when the motor is used to lower a load. The brake valve is similar to the pressure compensator valve except that the control spring is at the other end of the spool and a spring pilot relief valve is incorporated. Its function is to keep the pressure in front of the flow control valve constant (at 30 psi) under these conditions.

The brake valve never closes completely but remains open to pass the whole of the flow through the motor; it shuts sufficiently, however, to give the required back pressure to the motor. If this back pressure becomes so great that it might damage the fluid motor, the pilot relief valve opens, admits oil under the main valve and opens it sufficiently to keep the braking effect to the highest permissible figure. When this happens the flow control valve is not able to cope with the additional flow and the excess is passed out through the relief valve.

While braking, the pressure at X is slightly above 30 psi and the pressure compensator valve is kept full open by the pilot line pressure to keep the pump unloaded. There is no danger of cavitation in the motor, because the pump is still delivering. ▼▼▼

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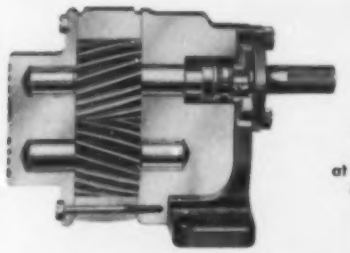
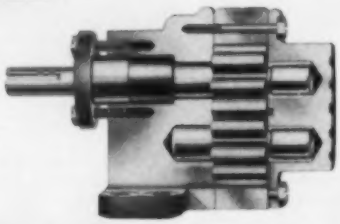
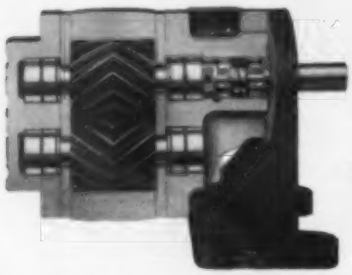


Helical gear type with mechanical seal and renewable bearings. For quiet operation at higher speeds—ideal for direct-coupling to motors.



Spur gear type with compression packing and renewable bearings.



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FOR TOP PERFORMANCE UNDER PRESSURE

APPLIED HYDRAULICS

COMPONENT DESIGN ARTICLE

DESIGN OF AN AIR CYLINDER

... for impact

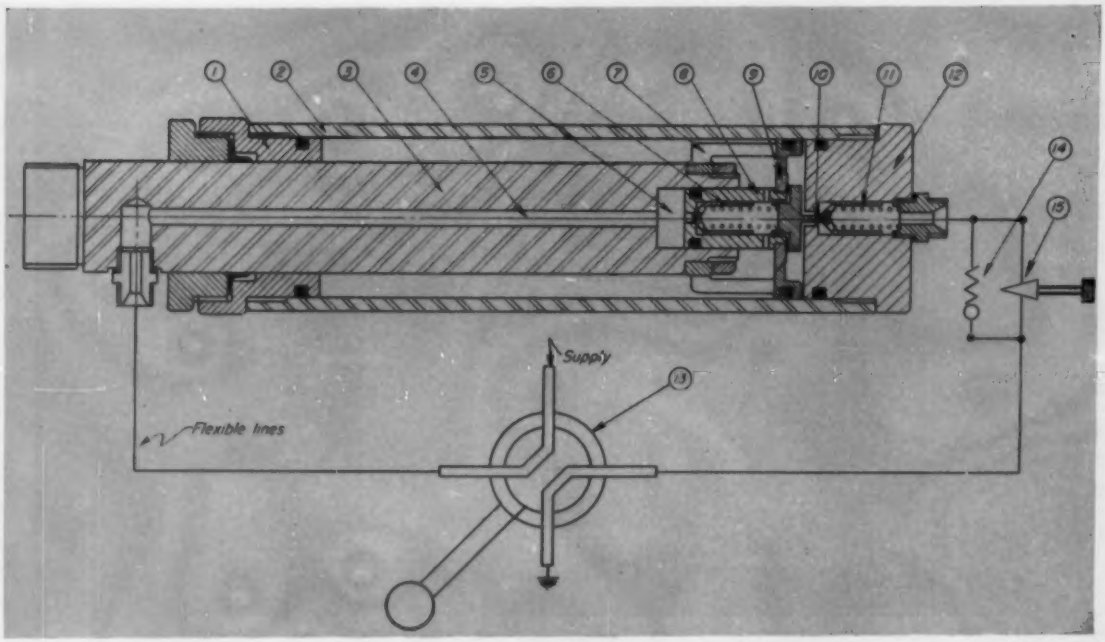
• By Eric Holdsworth

WHAT are the requirements of a cylinder designed specifically to give impact? They are: high velocity, good acceleration, low mechanical and fluid friction.

To meet these requirements the cylinder shown in the drawing was developed. The design permits trapped air to expand for the impact operation. The only air movement during impact is air through the piston. Orifice size is approximately equal to the area of the displaced member, resulting in low fluid friction. Only static sealing of the piston is required at the end of the return stroke at a low pressure differential; therefore, a single O-ring and short piston give low mechanical friction in the cylinder.

• **Operation**—In the position shown in the draw-

ERIC HOLDSWORTH, *Design Engineer, Leeds, England.*



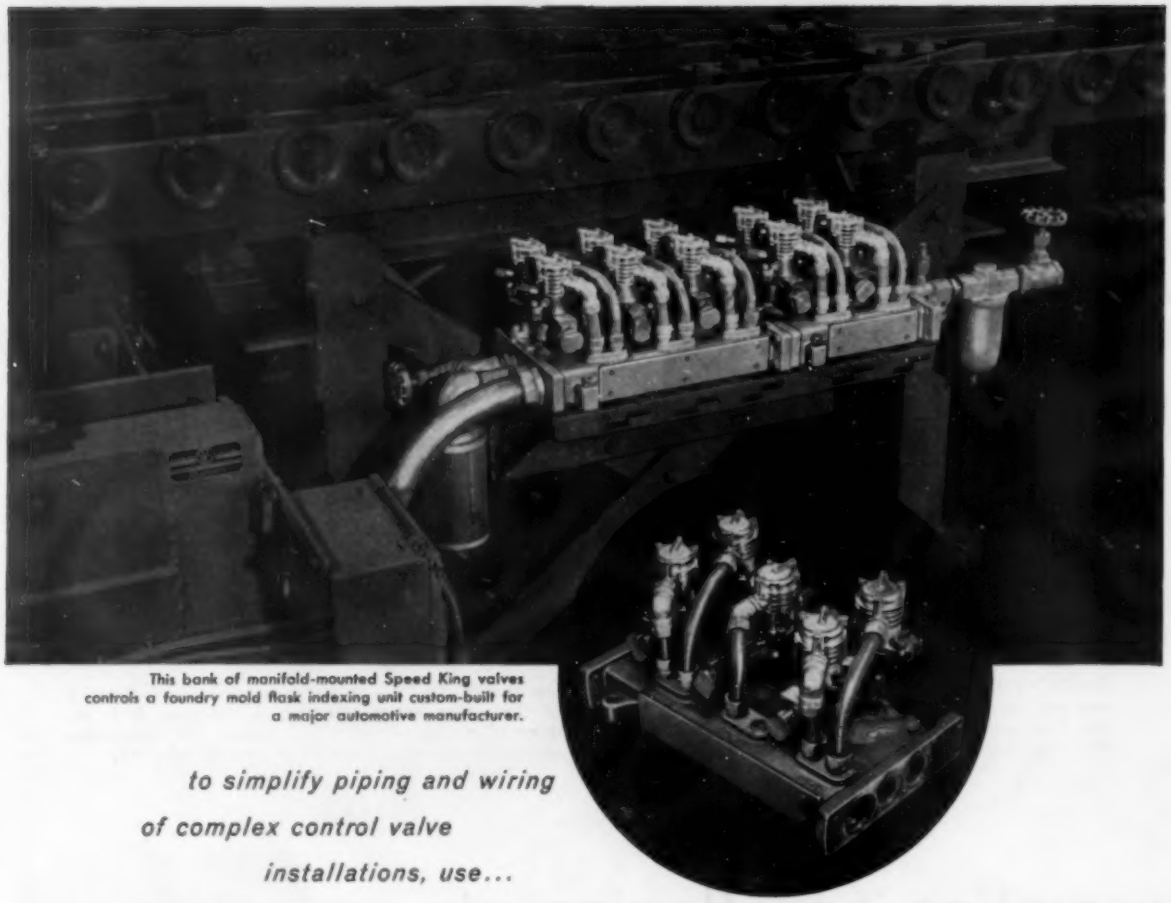
CONVENTIONAL cylinder 2, with gland 1 at one end and cap 12 sealing the other, is fitted with piston rod 3 of approximately 50% the area of cylinder 2. Piston is attached to rod by means of spider 7, allowing center of piston to house miter valve 9. Stem 8 of this valve enters chamber 5. In stem 8 is sequence/non-return valve 6. Tappet 10 can enter passage in cylinder head 12 to contact valve 11.

operation by allowing air under compression to expand rapidly

ing, air pressure holds the rod retracted. To advance the piston rod and strike a blow, 4-way valve 13 is shifted. Chamber 5 is now open to exhaust. Valve 6 traps the air in the cylinder annulus. Supply air is now directed through check valve 14 and through valve 11 to head 12. This valve is held open by tappet 10. As pressure rises above the piston, the miter-valve 9 shifts to the open position, due to the absence of sustaining pressure on stem 8. As this valve snaps open, tappet 10 releases the valve 11, which seats and isolates the cylinder from further entry of air.

The trapped air in the cylinder expands and acts on the rod area to cause rod 3 to advance. As it advances along with its piston, air freely transfers between the upper and lower chamber via the large orifice created on opening of valve 9.

When the required blow has been struck and it is desired to restrict rod 3, the 4-way valve 13 is shifted to the position shown. Air from supply now acts on stem 8 to close valve 9 and pass via valve 6 into the cylinder annulus which is now once more isolated from the upper end of the cylinder. At the same time the upper end of the cylinder, via valve 11, and restrictor 15, is opened to atmosphere through valve 13. The rod then retracts, but due to the restrictor 15 the expanded air is slightly recompressed, which exerts a balancing force in the upper chamber and brings the rod and piston assembly gently to rest against the head 12. As the upper extremity is reached the tappet 10 engages with the valve to retain it open in readiness for a further admission of air to initiate another stroke. ▼▼▼



This bank of manifold-mounted Speed King valves controls a foundry mold flask indexing unit custom-built for a major automotive manufacturer.

to simplify piping and wiring of complex control valve installations, use...

VALVAIR'S NEW SPEED KING MANIFOLDS

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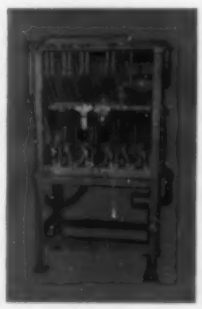

Ganged 3 station Speed King manifolds provide neat piping . . . simplify construction and maintenance of this master control console which operates a battery of automated foundry equipment.

PIPING	—1 in. NPT intake and exhaust ports, common to all stations. Pipe threads, both ends, and O-ring grooves.
PORTING	—Optional ⅜ or ½ in. NPT cylinder ports. Side and bottom outlets, flush pipe plugs.
WIRING	—1¼ in. conduit passage, with side access cover, common to all stations. Pipe threads, both ends, and O-ring grooves. Pilot leads encased in flexible conduit.
VALVES	—2 or 3 stations for single and double solenoid Speed King valves. 2, 3 and 4-way; remote-operated; speed controlled; and power-centered neutral valves may be used in any number and combination.
MOUNTING	—2 mounting legs per manifold. Kits of O-rings and through bolts, for ganging, also available.

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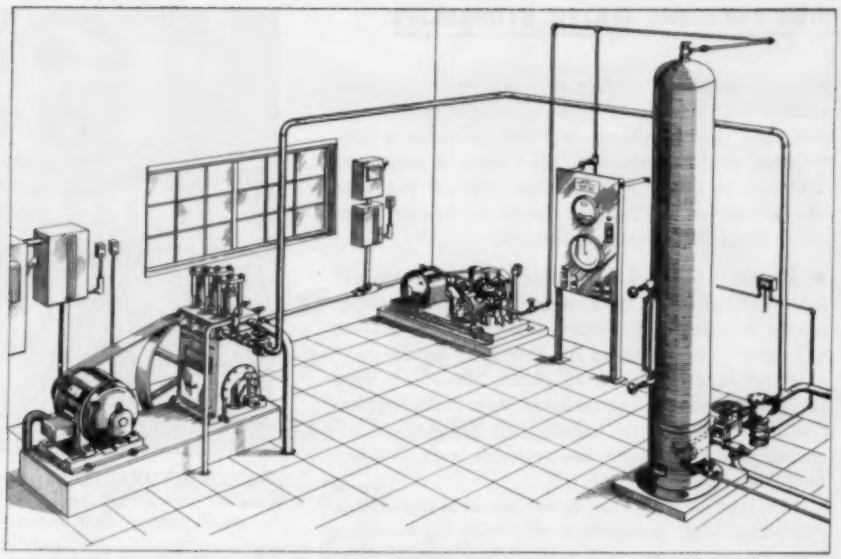


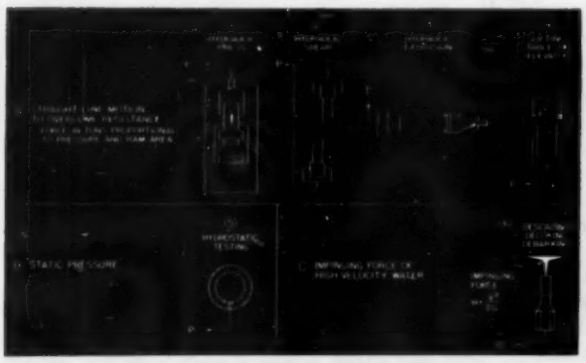
CENTRAL POWER STATIONS in many plants include a reciprocating power pump and accumulator to supply water pressure for powering presses and equipment throughout the plant. This installation is typical for many plastic, rubber and metal working plants.

HIGH PRESSURE WATER HYDRAULICS

. . . supplied by multiple plunger pumps

Hydraulic forging and extrusion presses applying forces up to 50,000 tons, and operating at 4500 psi, can use water as the medium. As high flow rate is only required intermittently, an accumulator is used, eliminating the need for an excessively large multiple plunger pump.

• By R. K. Grobholz



HIGH PRESSURE water hydraulics has many uses, from powering presses to descaling and debarking with jets.

FORGING presses for heated metal billets, die casting machines and rubber or plastic molding presses are commonly powered by high pressure fluids. In extrusion presses, enough force is developed to squeeze metals through dies. Originally restricted to aluminum, bronze and the softer alloys, extrusions are now being made of harder and more durable metals such as chrome stainless steel. In some applications, requiring large quantities of fluid, water is an ideal medium.

• **Why water hydraulics?:** Many hydraulic press applications involve red hot or molten metals. The slightest oil leak at high pressure could throw inflammable oil 30 or 40 feet. Use of fire-resistant fluid is necessary to eliminate the fire hazard. Fire-

R. K. GROBHOLZ, *Worthington Corporation*

resistant fluids are more costly, and in large plants leakage loss may be as much as 25,000 gallons per year. For these applications water provides a fire-resistant medium with the advantage of economy. Addition of up to 5 percent soluble oil provides lubrication for valves and rams in the system without making the mixture flammable.

• **Pumps:** Since close clearance rotary pumps will not perform well with water, multiple plunger pumps are required. Several pumps on the market will satisfy requirements for this type service.

Direct flow reciprocating pumps are widely used for high-pressure, high-volume hydraulic applications. Triplex pumps handle the majority of requirements, but models are available with as many as 9 plungers.

This type of pump has close-clearance liquid end, providing high volumetric efficiency in handling light as well as heavy liquids. Valve arrangement is such that the liquid follows a straight path through the pulsation chamber.

Separate interchangeable stuffing box barrels allow for interchangeability of several plunger sizes within a given cylinder size. Conversions can be easily made in the field. For example, on a 5-inch stroke pump, plungers are interchangeable within two sizes of fluid ends. This provides a range of pressures from 700 to 2700 psi with displacement of 15 to 225 gpm. On the 3-inch stroke model, range is from 800 to 2600 psi and 5 to 95 gpm. Another model triplex pump has a range of 700 to 12,000 psi and 2 to 225 gpm.

These pumps feature a sectionalized fluid end which permits easy access for maintenance and inspection. Individual fluid end sections can be replaced at a fraction of the cost of an entire fluid-end unit.

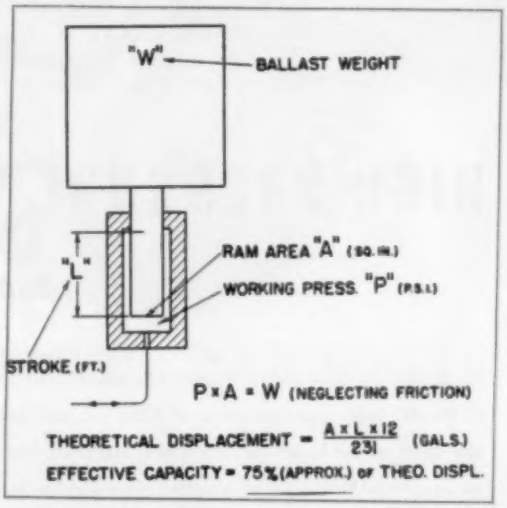
Drive units may be electric motor, steam turbine, steam engine or internal combustion engine. Drive connection may be direct through a flexible coupling, by pulley or V-belt, by speed reducer through flexible coupling or by built-in speed reducer. On the smaller sizes an integral pump and motor base is supplied on direct or geared reduction units.

• **Accumulators:** Peak flows for the presses are supplied by the accumulators. During periods of no demand, the small pump (sized only for the average flow rate) replenishes the accumulator for the next demand.

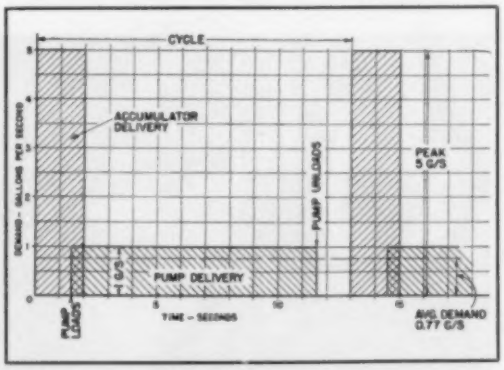
One of the older type accumulators has a weight on the plunger. Pressure in the cylinder is simply the weight times the ram area. Withdrawal of water from the cylinder causes the ram to drop. As it does, it contacts a limit switch that loads the pump. Discharge from the pump raises the ram and weight to the point where another limit switch unloads the pump. This design is acceptable only for smaller

Concluded on page 114

WATER HYDRAULICS powers this 18,000 ton die forging press. High operating pressures are produced by small pumps with accumulators.


"W"
BALLAST WEIGHT
"L"
RAM AREA "A" (SQ. IN.)
WORKING PRESS. "P" (P.S.I.)
STROKE (FT.)
P x A = W (NEGLECTING FRICTION)
THEORETICAL DISPLACEMENT = A x L x 12 / 231 (GALS.)
EFFECTIVE CAPACITY = 75% (APPROX.) of THEO. DISPL.

SIMPLE TYPE accumulator is pressurized by weight on the ram. Inertia of the moving mass causes shock loads not acceptable in larger installations.



ACCUMULATOR furnishes peak loads for intermittent requirements, eliminating need for large pump. Small pump refills unit for the next demand.

A name famous for precision now produces reciprocating torque actuators

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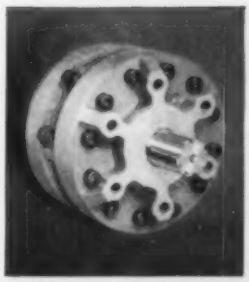

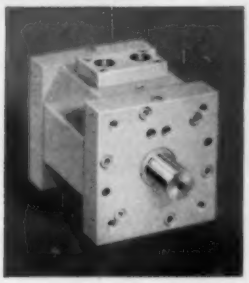

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EASY LOADING

FIG. 1. Air cylinders operate the horizontal plates which support the product while the roller sections are swung down by another air cylinder to permit entry of carton flaps.

FIG. 2. Carton is placed over the appliance with two side flaps down. Operator at right is stepping on foot control to swing down the roller section for insertion of flaps.

Pneumatic operation permits use of conveyor belts instead of chain conveyors which would require elaborate timing systems. With air circuits, simple arrangements of limit switches do the job.

Economical, efficient

CLOSING AND SEALING WITH AIR

THIS rapid, assembly-line packaging system uses air-operated equipment designed by the engineering staff of Hinde & Dauch. Illustrations show a typical application in the washing machine line at the Whirlpool Corporation, Clyde, Ohio.

The method is applicable to a wide range of major appliances. Two new ideas are incorporated: A bottom flap closing device, and a means of closing the outer flaps for sealing.

Air was selected as the operating medium because it permitted the use of conveyor belting. Otherwise, a chain conveyor would be necessary, requiring an elaborate timing system to activate the flap closing arms at the proper time. With pneumatic circuits, this is accomplished through a simple arrangement of limit switches.

Operations are performed smoothly and continuously, from the covering of the product to the final sealing. This application of pneumatics has speeded up packaging operations, saved floor space, allowed the use of less costly packages and resulted in a labor-saving of from 30 to 50 percent.

All air components are standard and the equipment illustrated occupies a linear space of only 50 feet. The line was set up over a weekend, and within one hour of the next work day, production was being handled. ▼▼▼

SIMULTANEOUS GLUING

FIG. 3. Entering the gluing section where a clevis type air cylinder, angular mounted above the frame, raises and lowers the rollers to adjust for varying box heights.

FIG. 4. Glue rolls coat top and bottom closing flaps at the same time as carton moves through the gluing section.

RAPID SEALING

FIG. 5. Split-belt conveyor section permits closing top and bottom flaps, on one side at a time, while maintaining movement of carton. Air-operated flap closing arms are actuated by limit switches. Horizontal side guide bars hold the box upright.

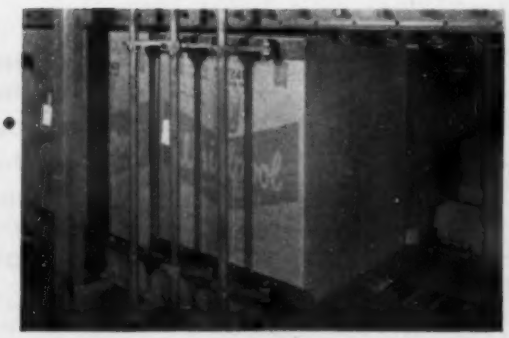

FIG. 6. Carton squaring arms are operated by a base mounted air cylinder through toggle linkage. Arms open as carton contacts limit switch, shown at lower right at conveyor belt line, and close when carton is past. Compression rollers apply sealing pressure.

Saves 40% Space!

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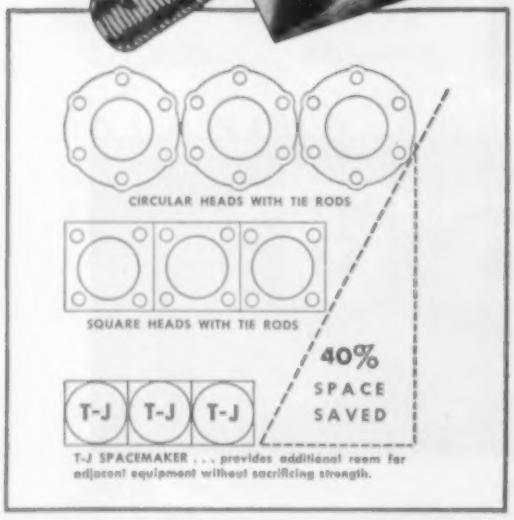

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MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

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RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Problem Clinic

• By Ransom Tyler,

ELECTRICAL PRESSURE CONTROL

DECOMPRESSION of a press is a problem which can be solved by electrical controls and a variable-volume, reversible pump. A considerable amount of energy can be stored in the elasticity of a large press. Part of this energy is stored in the oil which is usually stressed to 3000 or 5000 psi, and part is stored in the steel structure which is sometimes stressed to 20,000 or 30,000 psi. In some cases, a very large amount is stored in elastic work or tools, such as rubber pads which are used in certain forming operations.

If the pressure is suddenly released, a severe shock occurs stressing the piping and other elements of the system. Designers of press circuits use valves or other controls to release the energy slowly over a period of time which often reaches several seconds.

A similar shock occurs if pump output is directed to the rod end of the press ram before the head end pressure has been completely released. The cylinder is prevented from moving because of the pressure which has been built up previously on the head end.

One solution to this problem is illustrated in Figure 1. The pressure switch is actuated on pressure rise and opens the circuit to the RETURN solenoid in the pump directional control. After completion of the stroke, the PRESS solenoid is deactuated stroking the pump to neutral, and the valve is shifted to meter fluid from the cylinder for a controlled decompression. When the pressure has dropped to a preset valve, the pressure switch is deactuated energizing the RETURN solenoid, so that the pump delivers to the rod end of the cylinder to raise it.

COMBINATION CIRCUIT

When a pressure switch is used to limit maximum pressure, a relief valve should also be used if pressure rise might be faster than the response of the pressure switch. The time element involved in tripping a pressure switch which actuates associated electrical components to control a valve and pump displacement may be an appreciable fraction of a second allowing dangerously high peaks to occur. The relief valve provides a passage through which the excess oil can be relieved. The

Continued on next page

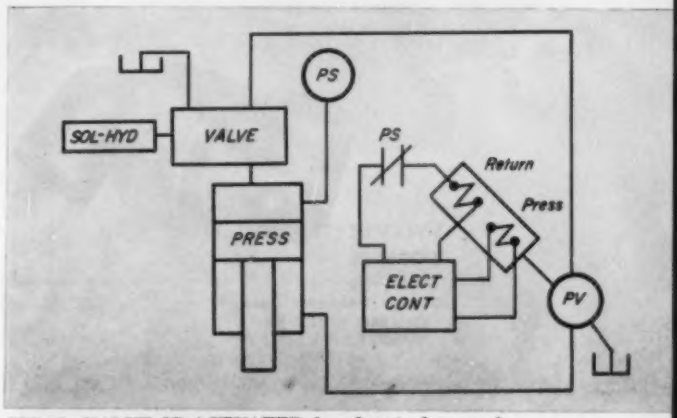

FIG. 1. VALVE IS ACTUATED by electrical control to meter oil from head end of cylinder providing controlled decompression. Pressure switch actuates solenoid-operated pump stroke control.

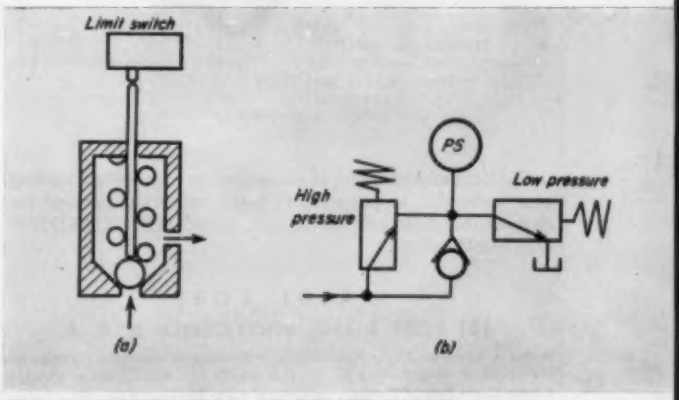

FIG. 2. COMBINATION OF RELIEF VALVE and pressure switch or limit switch insures pressure limiting even when pressure rise is more rapid than response of pressure switch.

RANSOM TYLER, *Chief Application Engineer, The Oilgear Co., Milwaukee, Wis.*

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SEALOL

THE BALANCED PRESSURE SEAL

PROBLEM CLINIC

Concluded from page 113

pressure switch and relief valve can be combined to provide a single adjustment for pressure control.

Figure 2 shows two arrangements for use where the maximum pressure must be adjusted over a considerable range. In (a) a specially built device utilizes the very small movement of the relief valve plunger to trip a sensitive limit switch. This design depends upon a certain minimum flow for operation—perhaps 1/10 of its maximum capacity. Therefore it must be used with caution in a system of varying flow. The arrangement shown in (b) can be assembled from standard commercial components, although integral assemblies of this type have been produced. The high-pressure valve can be adjusted over a wide range of pressures. The low-pressure valve need be set only high enough to actuate the pressure switch. The small check valve provides a path for the escape of fluid when the pressure in the line to be controlled falls below the setting of the low-pressure relief valve. If this line is always under pressure, this is not possible and a bleed-off valve should be installed in parallel with the low-pressure valve.

▼▼▼

HIGH PRESSURE WATER HYDRAULICS

Concluded from page 108

installations, due to leakage, packing maintenance and hydraulic shock caused by inertia of the moving mass.

The most simple and foolproof accumulator has no moving parts. It is merely a pressure vessel, partly filled with water and the rest compressed air. Pressure switches take the place of limit switches, since the air at the top of the vessel expands and compresses as water is withdrawn or restored. Air bottle accumulators are sized to provide the necessary water volume with a limited pressure drop, usually not exceeding 10 percent.

• **Typical applications:** Schematic illustrations are given for some common uses of high-pressure water. They are:

a. Straight line motion for hydraulic pressing, shearing or extruding, and table or elevator lifting. Proper combination of press and ram area produces the necessary tonnage.

b. Static pressure. Small reciprocating pumps are used for hydrostatic testing of piping, valves and pressure vessels. Equipment to be tested is first filled from a low pressure source. Only a small flow is needed to build up quickly to test any slight leakage.

c. Impinging force for descaling, decoking and debarking. Scale is removed from metal most effectively with hydraulic jets. Chilling effect of the water shrinks the scale, impact of the jet breaks the scale into small particles and hitting at a 15-degree angle gives the jet a peeling action.

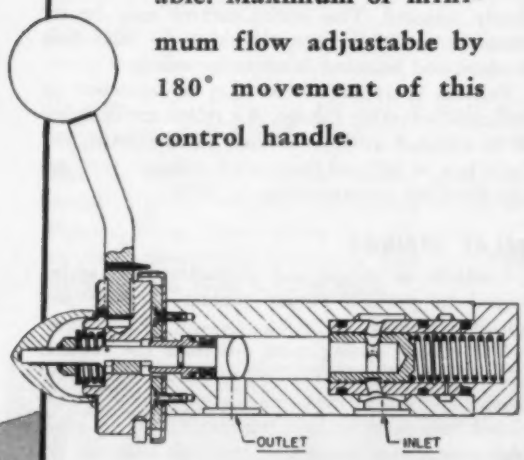
▼▼▼

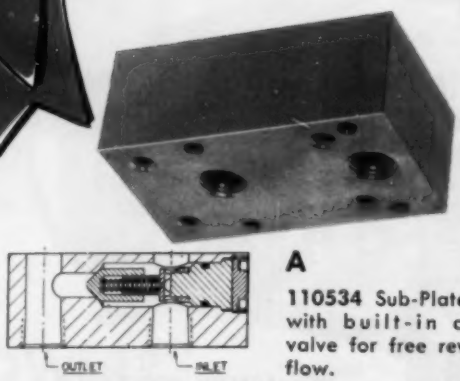
Another WATERMAN WINNER

Adjustable Flow Regulator

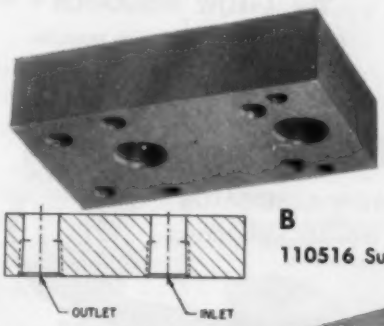
An adjustable flow regulator adapted for manifold mounting. Sub-plate kits are furnished with built-in check valves for free reverse flow. They are interchangeable, dependable, light-weight and easily installed.

Either right or left hand rotation of control handle is available. Maximum or minimum flow adjustable by 180° movement of this control handle.





A
110534 Sub-Plate Kit with built-in check valve for free reverse flow.



B
110516 Sub-Plate Kit.

Write for illustrated bulletin A, describing the many valuable features of this Adjustable Flow Regulator.

WATERMAN ENGINEERING COMPANY

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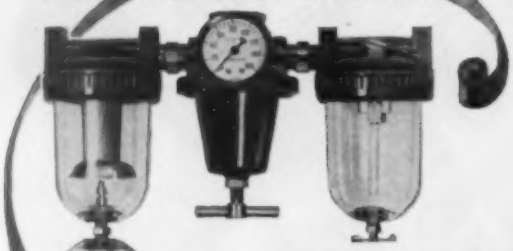
ARROW

AUTOPNEUMATIC CONTROL



The one top quality assembly that performs the complete job for thorough conditioning and control of compressed air used to power all types of pneumatic tools and appliances.

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high flow capacity with filtration as required and low pressure drop.

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automatically disposes of collected moisture from filter with no loss of compressed air.

Assemblies and separate units supplied in pipe line sizes from ¼" NPT through 2" NPT.

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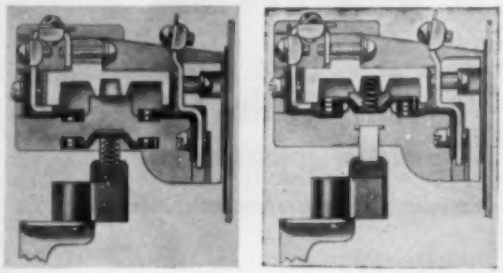
RELAYS AND CONTACTORS

Concluded from page 81

ratings of contactors are actually given as 8-hour ratings, so that the contactor should operate at least once every eight hours. Because all copper contacts and most silver contacts have *wipe*, or a



Courtesy Square D Co.

INTERCHANGEABLE CONTACTS permit converting normally-open contacts to normally-closed contacts and vice versa. This illustration also shows action of the spring which holds the contacts together.

scraping action when they are closed, this frequency of operation will remove corrosion products which build up even while the contacts are conducting. If a contactor is not to be operated at least once every eight hours, it should have silver contacts because of the conductivity of silver oxide.

RELAY COIL

The relay coil is wound on a spool and mounted on the magnet. In a-c relays, the inductance of the coil contributes to its total impedance and the resistance of the coil is usually much lower than in d-c relays.

In a-c contactors the inductance of the coil is a function of the air gap in the magnetic circuit, and the coil will draw more current at the beginning of actuation than when the relay is completely actuated. This initial current may be six times the normal current, so that if the relay fails to close, coil burn-out is likely to occur.

Reliable operation of the relay is dependent on sufficient actuating voltage. A-c relays are designed to be actuated at 85% of their rated voltage, and d-c relays at 80% of their rated voltage. They are also rated for an overvoltage of 10%.

RELAY SPRINGS

Contacts of relays and contactors are spring loaded to provide proper contact pressure and positive closing.

The contact spring must deactuate the contacts quickly to extinguish the arc, and must also permit them to close without bounce or chatter. Once closed they must be held together tightly to avoid high contact resistance and resultant heating.

RELAY TERMINALS

The most common types of terminals for making connections to the relay are screw lugs, solder

Concluded on page 118

MODEL K
Vane Type
Variable Volume
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Pressures to 1000 psi
Up to 1200 rpm

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Hydraulic Power consumption is measured by the amount of oil pumped and the pressure needs of the circuit. Seldom do you need maximum output from the pump *and* top pressure throughout an operating cycle.

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Designed to your space
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- ✓ THE CHAR-LYNN POWER PAC eliminates sprockets, chains and pulleys.
- ✓ THE CHAR-LYNN POWER PAC offers space saving compact power at LOWER COST.

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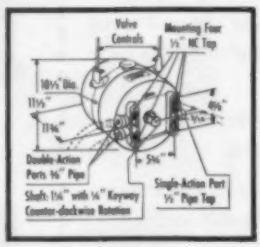
DELIVERY. Up to 12 gpm. Up to 10 h.p.
RESERVOIR CAPACITY. 2½ gallons or more as needed.
RELIEF VALVE. Cartridge-type, spring-loaded, ball-check. Set 1,000 pounds.
CONTROL VALVES. Two-way Valve for Single-Acting Cylinder—Four-way for Double-Acting Cylinders.
FILTER. Enclosed within Reservoir—protects all moving parts. Fine brass screen easily cleaned or changed.
DRIVE. Direct from PTO shaft, or high-speed belt or chain drives.
OPERATING RANGE. 200-1200 rpm.



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F-240 filter

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RELAYS AND CONTACTORS

Concluded from page 116

terminals, plug and socket, and quick-connect pin and socket couplers. The screw type is the most common on industrial relays, although plug-in units are coming into increased use because of the simplicity of replacement.

ENCLOSURES

Relays and contactors are usually panel mounted with other electrical control equipment, although dust-tight, water-tight, and explosion-proof enclosures are available. Some of the smaller plug-in relays are enclosed in a clear plastic housing which provides protection and at the same time permits regular inspection. For complete protection the relay should be hermetically sealed in an enclosure which is filled with an inert gas. A disadvantage of this design is that the volatile products of relay operation are confined in a small space without ventilation, so that this atmosphere becomes contaminated within a short time. ▼▼▼

OPPOSING CYLINDERS

Concluded from page 78

Pressure on the wedge cylinder is maintained by an accumulator. The pump runs only long enough to make up for leakage, or when alignment of the roll is required, and is controlled by a pressure switch installed with the accumulator. This pressure switch is set to close at 450 psi and open at 1000 psi, operating the pump intermittently to maintain accumulator pressure between these limits. Because of space limitations and mounting requirements, a piston type accumulator was selected.

The wedge cylinder functions with a latch cylinder which releases the locking mechanism. The single-acting latch cylinder is connected so that it is drained when the latch cylinder is extended. Pressure is applied to the latch cylinder when the wedge cylinder is retracted. These two cylinders are controlled by a 4-way, spring-loaded, foot-operated valve. In the spring-loaded position, this valve applies pressure to lock the wedge cylinder in place. This is a safety feature insuring that an operator is standing at the control station depressing the foot valve before the coil holding cones can be moved apart.

Accidental operation of the manual valves controlling the cone cylinders has no effect, because of the check valve which maintains pressure on the accumulator and pressure switch, so that the pump is not running. The cones remain locked in place until the foot valve is operated.

Other units in the press feed line also employ hydraulic operation. Flexing rolls which eliminate strain in the metal must be raised and lowered when the sheet is threaded through the units. This is accomplished by a rotary actuator coupled to the flex rolls through a rack and pinion arrangement. ▼▼▼

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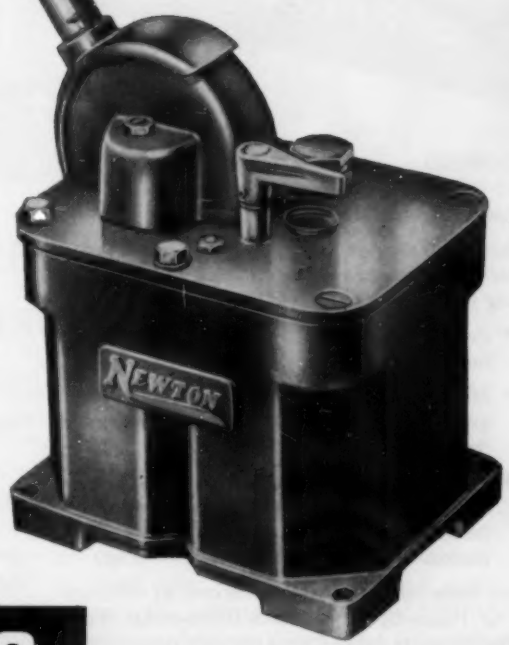
HYDRAULIC PUMPS of proved efficiency for hand or power operation



TECHNICAL DATA

Normal operating pressure . . 1,500 lbs. sq. in.

Maximum operating pressure (Blow Off) . . . 2,500 lbs. sq. in. *(or to specification)*

Output complete stroke . . . . . ·825 cu. ins.

Effective piston area . . . . . ·600 ins.

Handle leverage ratio . . . . . 16—1

Alternative fluid capacities in pints . . . 2¾ pts., 6 pts., 16pts., 24 pts., 32 pts.

Larger capacities to special order.

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WHY NOT HYDROSTATICS?

Concluded from page 85

braking movements can be achieved. It is not unlikely that to gain sufficient stability of roadwheel speed, when travelling at constant speed, an elementary servo mechanical control incorporating feed back principles, may be required.

• **Braking**—A most pressing problem is controlling the rate of braking, whether a one or two pedal control system is used. Clearly, reversal of the swashplate tilt angle in effect puts the vehicle shocklessly into reverse and gives the maximum possible braking efficiency that the suspension and weight distribution of the vehicle will allow. But the system has obvious disadvantages, not only in the liability to excessive tire wear, but also in the disagreeable consequences of applying too much braking effort and finding one-self motoring backwards!

Here is a tentative proposal to obviate such alarms. The reverse torque applied to the wheel motors is a measure of the degree of braking exerted, and this in turn is a function of the circuit pressure. This can be controlled by including a relief valve. A possible line of development, also, is the inclusion of an accumulator on this side of the circuit, so that braking is regenerative. Such a device would save power, improve economy, and assist in the thermodynamic problems of braking. Without some such arrangement, the kinetic energy of the moving vehicle must be translated to heat energy in the fluid medium, and must be dissipated if reasonably constant viscosity, and hence volumetric efficiency, is to be attained. Such heat dissipation is wasteful and may require added expense in installing a heat exchanger.

Considering the braking problem a stage further, the faster the vehicle is travelling the greater must be the braking torque applied to retard its motion. On the other hand, the rate of application of braking may have to be more gentle if the roadwheels are not to change their direction of rotation, while the vehicle continues to travel forward virtually out of control, traction being lost. This suggests that the relief valve should be coupled to the flow, so that the torque limiting characteristic becomes a function of the fluid flow. This is stating the matter very baldly, and it clearly demands deeper consideration.

The fundamental circuit may take one of several forms, but it is likely that a booster system with the wheel motors connected in parallel, may prove acceptable, though the necessity for the differential action may involve other considerations.

It is not possible to do more than gloss over the surface of the fascinating potentialities of this type of automotive transmission in the present article. Possibly, however, enough has been said to arouse the interest of some readers. The author is hoping to produce an experimental prototype in the near future, when detail designs have been formulated, and to publish the results of these experiments. ▼▼▼

In this case, Schrader Double Acting Cylinders measure amounts of chocolate to be pumped into wax molds in this candy-making operation. Schrader Flow Control Valves, also indicated in red, control speed of cylinder action. Hundreds of other Schrader Products make "automating with air" easy to adapt to almost any manufacturing hookup.

Schrader Air Products fill candy molds with chocolate measured to ± 1 gram

Problem: To mass-produce candy figurines, filled solid with chocolate—a tricky sweet to handle. **Solution:** One Buffalo company uses a battery of Schrader Air Cylinders which measure the chocolate to within one gram, and precisely, neatly, swiftly fill the figures.

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FIRST NAME IN THE USE OF AIR
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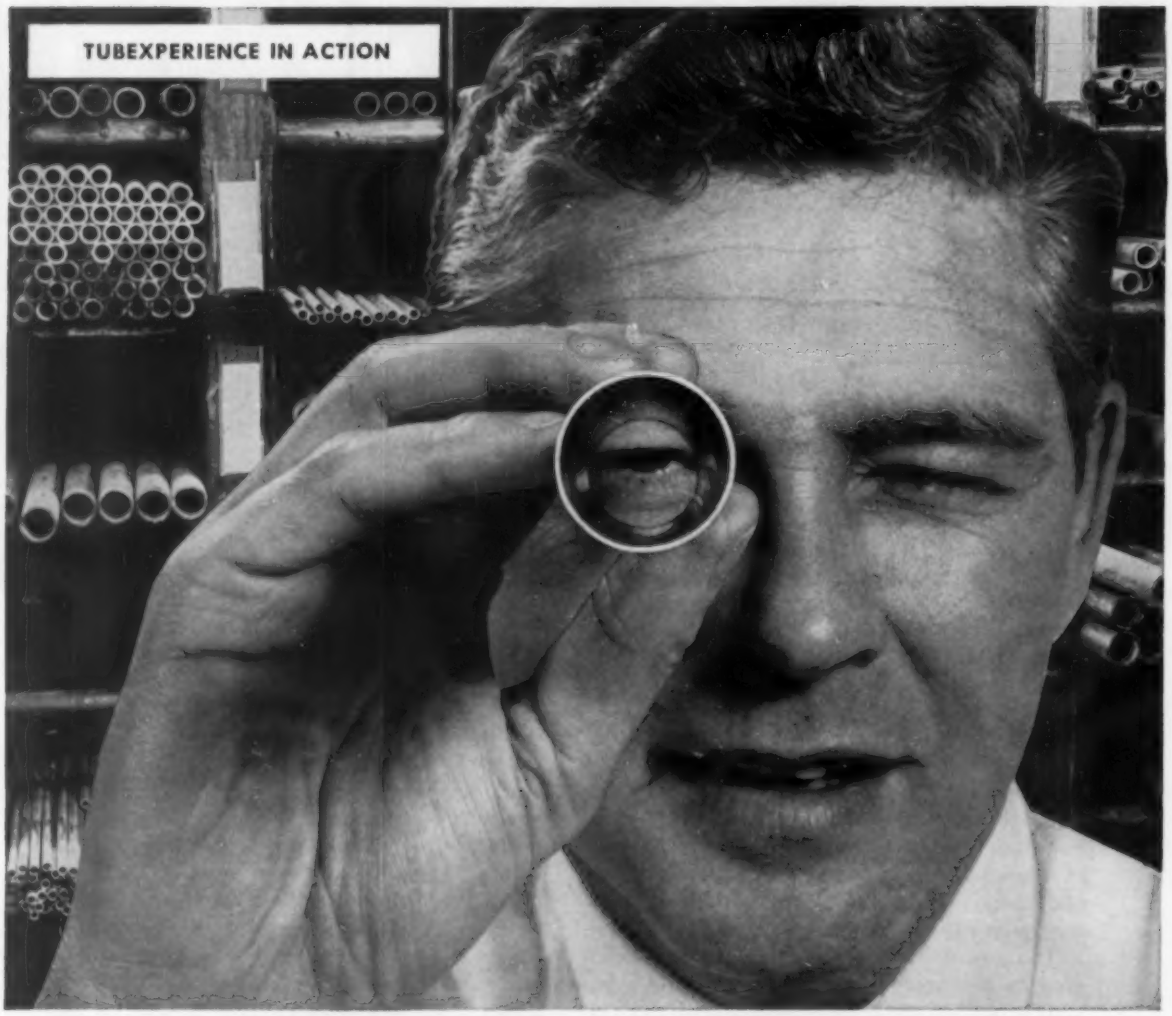
Your eye tells you why

Superior (SAE)

assures you of a more



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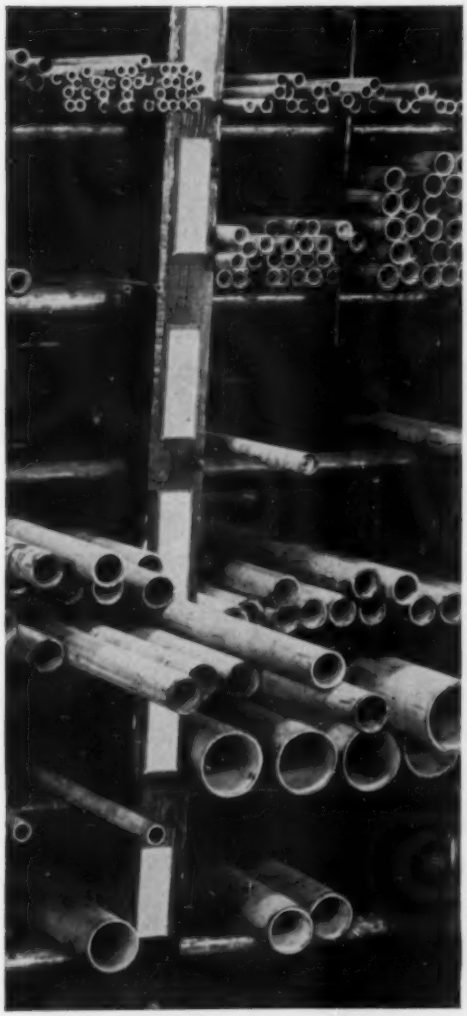

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COLD-DRAWN AND ANNEALED several times after initial reduction, Superior hydraulic tubing always reveals an excellent fine-grain structure under microscopic examination.

CONTROLLED ATMOSPHERE ANNEALING prevents carbon pickup, assures a maximum carbon content of only 0.12%. This results in non-aging, ductile tubing with bright, scalefree OD and ID.

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All analyses .010 in. to ⅜ in. OD—certain analyses in light walls up to 2½ in. OD

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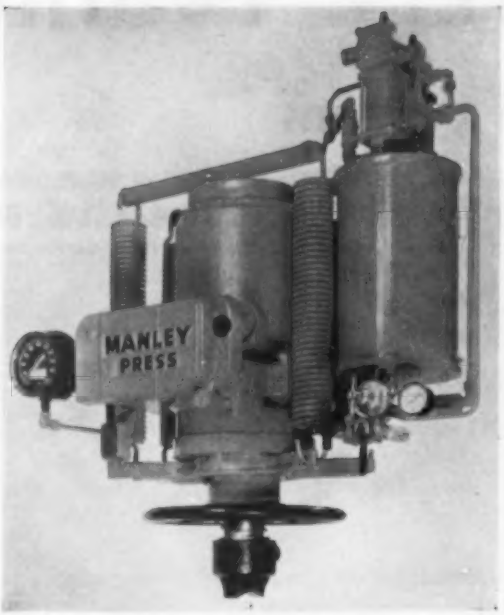
AIR BOOSTER PUMP

. . . gives small



POWER UNIT is operated by air. Ram is single-acting. Entire unit is mounted on wheels in the press head frame. Cylinder is of welded construction.

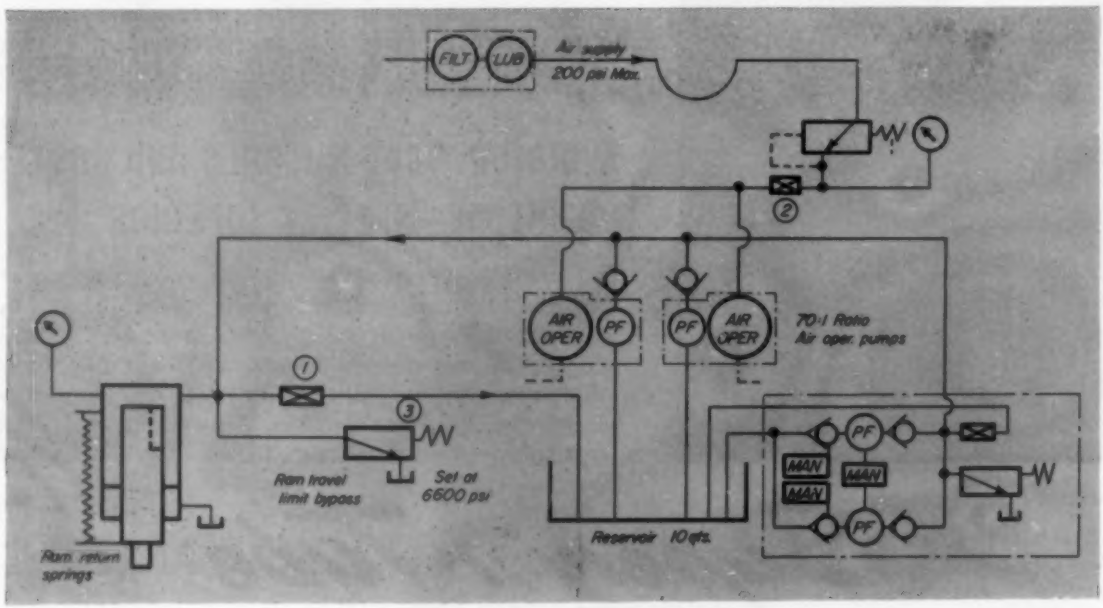
FLEXIBILITY, safety and economy head the requirements which maintenance men have for equipment in their shops. A press used for maintenance and repair work will be called on to do many different jobs during a work week.

Air-hydraulic power helps meet the important press requirements. Large work forces are economically developed by a small power unit. Operation is simple and takes little manual effort. Safety can be assured by mechanical locking and automatically actuated overload valves.

Designed by Manley Division, American Chain & Cable Co., Inc., this 150 ton press is offered with two types of hydraulic power units. One is a hand operated piston pump; the second uses shop air pressure to drive the pump. Both systems are shown in the circuit drawing.

Here's how the press equipped with an air operated pump works: With the work and hydraulic head in proper alignment and the press table raised to the proper height, the hydraulic head is raised against the head channel by rotation of the locking lever which also prevents unintentional lateral movement during the operating cycle.

Rotation of the manual screw extension hand-



PUMP operation by air or hand is shown in the composite drawing. At 6000 psi, a 300,000 pound force is developed by the press ram.

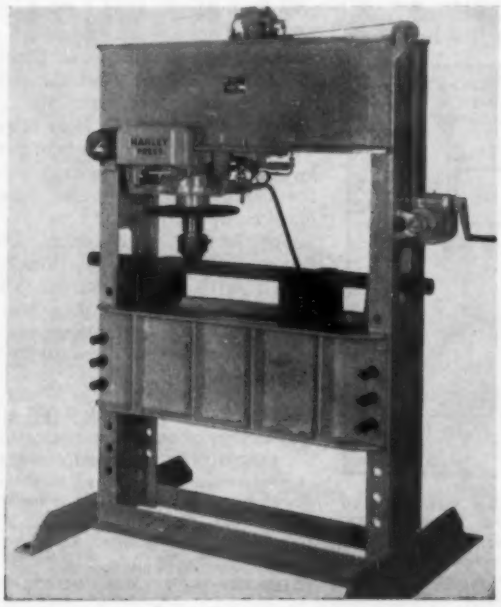
high force package

wheel places the nose piece in contact with the work.

Manual shut-off valve (1) is closed to allow pressure buildup. Valve (2) is opened to permit air pressure flow through the pressure regulator valve which is set to maintain the air pressure required to perform the work. Air passes to the two hydraulic pumps and is discharged to atmosphere after actuating the air cylinder driving the hydraulic pumps.

Action of the hydraulic pumps takes hydraulic fluid from the reservoir to the single acting work cylinder. Ram travel is readily stopped by cutting off the air supply. The ram is maintained under pressure in the extended position until the manual shut-off valve 1 is opened to relieve pressure and return hydraulic fluid to tank. Upon release of the work load, further ram retraction is caused by action of the ram return springs.

A relief valve (3) serves as overload protection, automatically discharging oil to the tank from the ram if loads exceed the rated capacity. Should the ram reach the limit of the allowable extension the ram travel by-pass in the ram automatically connects with the ram travel by-pass to the tank instantly stopping further extension of the ram. ▼▼▼



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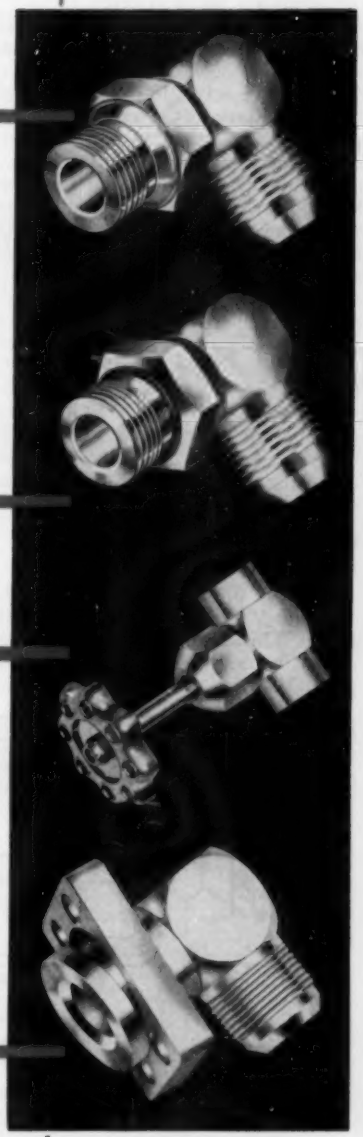

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The Vickers Servo Pump Unit shown at the right is a signal-controlled, variable delivery, positive displacement, reversible flow oil hydraulic pump. In combination with a rotary or linear hydraulic motor, it forms a signal-controlled hydraulic transmission for remote control operations and high-response servo systems.

The servo transmission may be considered as a power amplifier when viewed from the electrical signal input, of about five watts, to the mechanical power output of several thousand watts. Various sizes of transmissions have been built, having output capacity ratings from one to four hundred horsepower. The servo pump develops only that pressure required to move the load . . . which means reduced pressure over the greater part of the system life since peak loads occur only infrequently in the majority of systems. This greatly reduces power losses and minimizes heat rejection.

Any type of prime mover of sufficient capacity can be used to furnish the power input . . . electric motor, auxiliary drive pad on an airplane engine, air turbine, hydraulic motor, etc. Substantially constant speed is desirable.

Variable Pump Volume Controlled by Signal

Heart of the servo pump unit is the Vickers Variable Stroke Hydraulic Pump. This is usually a nine-cylinder pump housed in a pintle-mounted yoke. Varying the yoke angle varies piston stroke, hence, output volume from zero to maximum in either direction of flow. A stroking piston actuated by a pilot valve varies the yoke angle according to signal.

Low Control Power Requirement

Power for control purposes is low in a servo pump unit because metering valve action is confined to the volume-regulating system which is a low power level (100 to 300 psi) hydraulic system separate from the power transmission hydraulic circuit although a part of the pump unit. This volume-regulating system controls piston displacement and direction in the power pump which can operate at pressures up to 3000 or 4000 psi. Pressure drop across ports of a metering valve, with its inherent losses, is avoided in the power transmission system. Final power output from the pump is determined by the volume of flow which the volume-regulating system demands and by the actual resistance of the load . . . is not dependent upon pressure drop methods of control.

In a control system employing this servo pump, the variations in gain resulting from load change are negligible compared to those which may occur in a similar circuit controlled by a valve metering directly in the power line.

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The servo pump unit and its associated hydraulic motor are designed for high power-to-weight ratio, high torque-to-inertia ratio, low inertia of rotating parts, and high resonant frequency.

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High resonant frequency— 20 cps (entire system)

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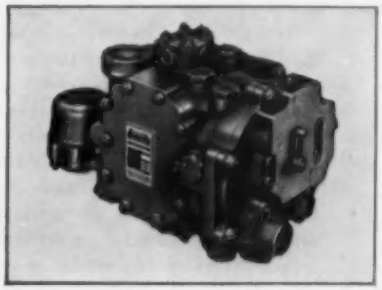
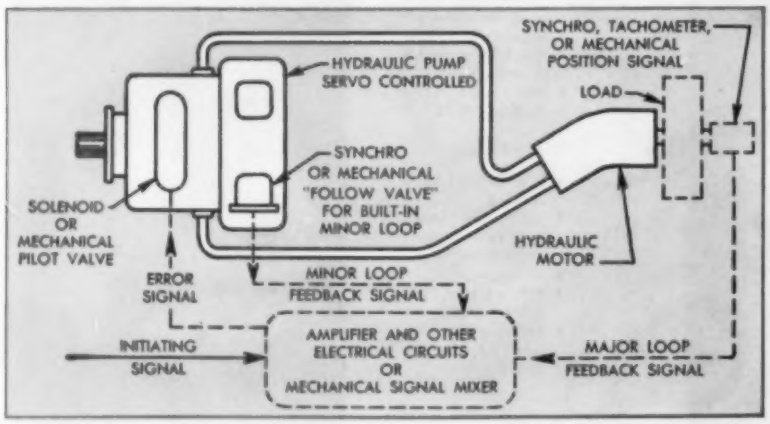


stepless speed changes and ability to hold position against any variation in load are additional reasons why this unit is a desirable resource which can solve many design problems.

Important among the applications of Vickers Servo Pump Units is extremely fast and accurate positioning of gun turrets on aircraft. Another is actuation of the exhaust nozzle for jet engines; here the servo pump's characteristic of providing at all times only sufficient power to meet the momentary demand minimizes the power loss and therefore the heat rejection. The greatly reduced average pressure level in this type of system prolongs the life and improves the reliability of all components.

For further information, ask for Bulletins SE-15 and SE-18 or get in touch with your nearest Vickers Aircraft Application Engineer. He can arrange for an engineering team to consider your problem and propose an optimum solution.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SIMPLIFIED DIAGRAM illustrates a servo control system employing Vickers Servo Pump Unit and Constant Displacement Hydraulic Motor. This system accepts initiating signals (either electronic or mechanical, depending on type of system), compares them with feedback signals from load and (through controlled changes in direction and volume of fluid pumped to motor) corrects the load as required. For added accuracy and stability, a minor loop providing signals proportional to rate of flow may be added. This may either be built into the pump in the form of a mechanical "follow valve" which results in modulating the flow as a function of the net signal to the pump, or may be a synchro which feeds a signal proportional to flow rate into the amplifier. The controlled output may be either a function of the position or velocity of the load.

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EVALUATING AIRCRAFT HYDRAULIC FILTERS

• By George R. Keller

A GROWING need for a better understanding of filters and filtration has accompanied improvements in slide valves and other close-clearance devices which require fine filtration. For instance some servo valves have radial clearances of 2 to 3 microns. However, at present no uniform method of evaluating filtration efficiency is in use by filter manufacturers, and no quick, easy methods of checking filters is available to the purchaser.

GEORGE R. KELLER, *Group Leader, Flight Control Engineering Dept., Autonetics, A Division of North American Aviation, Inc.*

A survey of filter manufacturers and users has disclosed a fair unanimity of evaluation methods for filter capacity, but a wide variation in methods for accurate measurement of filtration fineness and efficiency.

FILTER CAPACITY

The simplest and most satisfactory method of testing for filter capacity seems to be the determination of pressure drop across the filter as a function of increasing contamination. If the contaminant, Army Standard Fine Air Cleaner Test Dust

is fed in small increments into a test system immediately upstream of the filter, the filter will gradually become saturated. With constant flow, measurements of pressure differential across the filter can be plotted against the amount of contaminant added. Plots of these tests take the form of Figure 1.

Adding dust clogs the filter and reduces the number of openings in the filter. This clogging raises the pressure drop, and probably increases the fineness and apparent efficiency of the filter. At some

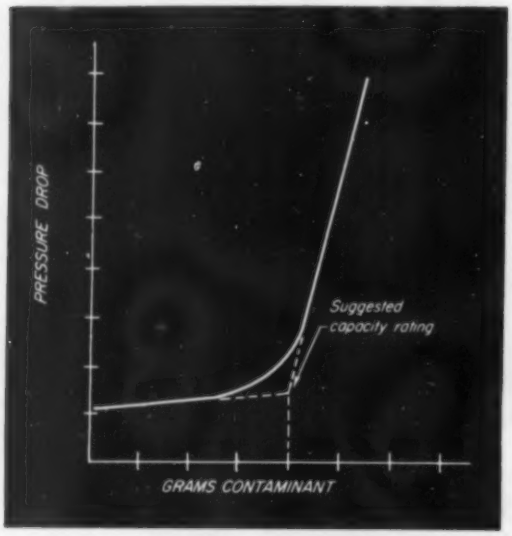

FIG. 1. FILTER CAPACITY can be checked by adding contaminant and measuring pressure across filter. The intersection of tangent lines is a suggested rating for capacity.

point, the filter becomes nearly saturated and the addition of more contaminant results in a large increase of differential pressure. One measure of filter capacity could be the quantity of contaminant which corresponds to the theoretical knee formed by the intersection of tangent lines drawn from the unsaturated and saturated portions of the curve.

FILTER EFFICIENCY

The techniques used for evaluating fineness of filtration include: a. tests of Specification MIL-F-5504, b. particle-count method using Army Standard Air Cleaner Test Dust, c. various methods of evaluating the weight or volume of sized glass beads which are passed through the filter.

In each of these techniques extreme care must be taken to avoid the effect of uncontrolled contaminant. The small percentage of contaminant in the fluid used in the tests emphasizes the effect of any contaminant initially in the system. Extreme care must be taken to insure that the test system is clean prior to conducting the test, and equally great care must be taken to insure a full accounting of all of the test contaminant which passes through the filter. Because airborne dust is in the size range of interest in aircraft hydraulic filtration, the presence of these dusts in the test system can cause erroneous results, and tests should be conducted in an air-conditioned, dust-free room.

The present filtration test of Specification MIL-F-5504A is used by some filter manufacturers to measure the efficiency of their filters. In this test, Army Standard Fine Air Cleaner Test Dust, or AC Test Dust for short, is added in increments to oil which has been previously filtered to 2 microns. After adding each increment of dust, the oil is pumped through the filter for five minutes. Filtered oil samples are centrifuged to separate the contaminant which is examined under a microscope to determine conformity with the specification requirement that 98% of all particles whose two smallest dimensions are greater than ten microns be removed. This is a rather lengthy test (50 hours) and the Naval Air Material Center has developed a substitute method for evaluating AN 6235 line type filters.

Some air frame companies have also been experimenting with a variation of this test. In one variation, an amount of AC Test Dust which corresponds to approximately 85% of the saturation capacity is added to the fluid. Eight ounce samples of the filtered fluid are withdrawn prior to adding the contaminant and after five minutes of pumping. The oil samples are drawn, by a vacuum process, through a Buchner-Coors funnel which is fitted with Aerosol Millipore Filter Paper, Type AA. The contaminant settles on the Millipore paper, above the holes in the Buchner-Coors funnel. A direct measurement by microscope may then be made of all the particles in one spot. The difference in contamination between the two measurements is assumed to be a measure of contamination which the filter does not extract from the fluid.

Because particles smaller than 1 micron are easily caught on the Millipore paper, extreme care must be taken to avoid contamination from airborne particles. Tests have shown that AN6235 filter elements will pass up to 40% of particles larger than 10 microns. Individual particles as large as 80 microns have been measured in the effluent.

This particle-count technique has the advantage of testing the filter for a wide range of particle sizes, and the AC Test Dust provides a randomized particle shape. The test is not difficult to perform if sufficiently clean working conditions are established. The use of Millipore paper assures an accurate catch of even very small particles.

Figure 2 shows the approximate distribution of particles in AC Test Dust. The large percentage of particles in the smaller sizes permits tests on fil-

ters which are rated finer than the nominal 10 microns.

However, the particle-count method has the disadvantage inherent in all sampling techniques. The sample merely approximates the total fluid. The care with which the test is conducted affects the accuracy of the approximation. Because the AC Test Dust is difficult to distinguish from any unwanted contaminant, there is the possibility of error due to the unwanted contaminant. Filtration efficiency with this method can be expressed only in terms of particle count:

$$\text{Efficiency} = \frac{x-y}{x} \times 100\%$$

where: x = Number of contaminant particles per ounce of unfiltered fluid which are greater than the reference dimension.
y = Number of contaminant particles per ounce of filtered fluid which are greater than the reference dimension.

GLASS BEAD TESTS

A number of filter manufacturers are now using an efficiency test in which sized glass beads are passed through the filter. Glass beads which are sized as shown in Figure 2 are available. The glass beads are held to a narrow range of diameters, and the mean bead diameter is slightly less than 14 microns, and more than 97% of the beads are in the 10-20 micron range.

Testing with these beads, as described by McCreary, consists of adding a fixed weight of beads to a known quantity of very clean oil. The oil is then pumped through the filter and stored until the beads which have passed through the filter have had time to settle to the bottom of the oil container. Most of the fluid is then siphoned off and discarded. The balance of the fluid is passed through a 5-micron, fritted glass filter which has been carefully weighed. The filter is then dried and weighed. The difference in weight is assumed to be the weight of glass beads which passed through the filter being tested. The filter efficiency with this test is expressed in terms of weight:

$$\text{Efficiency} = \frac{W_1 - W_2}{W_1} \times 100\%$$

where: W_1 = Weight of beads added to fluid.
W_2 = Gain in weight of fritted 5-micron filter.

This method requires a considerable amount of time—approximately 50 hours—to evaluate a filter. However, only about 2 hours are working hours, Most of the time is taken in settling the beads out of the oil. If extreme care is taken in maintaining clean conditions, the errors due to tramp contaminant or lost beads can be less than .5%.

This test appears to answer many of the problems associated with evaluating 10-micron filters. The method is precise, straight-forward and ultilizes equipment normally found in well equipped laboratories. However, certain questions pertaining to the use of this method must be raised. First, a glass bead is a uniform, reproducible object. Its shape and mechanical properties are easy to express mathematically. Nevertheless, a legitimate question can be asked as to how well a collection of spherical glass particles represent the contaminant to be found in hydraulic systems.

Second, Roach points out that particles which are about the same size as the clearances being protected cause little damage. A few particles much larger than the clearances can cause damage greatly out of proportion to their numbers. Because this test depends on weight measurements and because of the narrow size range of the beads, the test does not give a direct indication of the largest size particles which can pass through the filter. For instance, the beads might pass through a number of openings slightly larger than 10 microns or through one opening much larger than 10 microns. One case might result in a filter which is quite satisfactory in actual service, and the other in a filter which would be wholly unsatisfactory.

One filter manufacturer does examine the fritted filter microscopically in an attempt to determine the maximum diameter bead which has been passed. This might be a useful addition to the test.

Third, the use of a fritted filter rated at 5 microns as a means of trapping all the beads which have passed through a 10-micron filter seems questionable. All filters which the Author has seen tested pass particles much larger than their ratings. The use of the 5-micron filter might result in artificially high efficiency ratings. The use of Millipore filter paper might be used as a replacement for the fritted glass filter.

Fourth, although the glass bead method appears to provide many good solutions to problems of evaluating 10-micron filters, it cannot be used to evaluate the 5-micron and 2-micron filters which

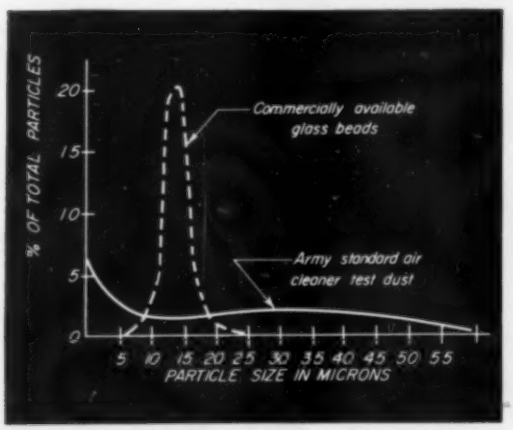

FIG. 2. SIZE DISTRIBUTION of particles in AC Test Dust and glass beads. Narrow range of glass beads limits their similarity to actual contaminants.

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An interesting variation and addition to this method has been suggested by one filter manufacturer. In this approach, glass beads having ranges of 0 to 40 or 0 to 80 microns are added to clean

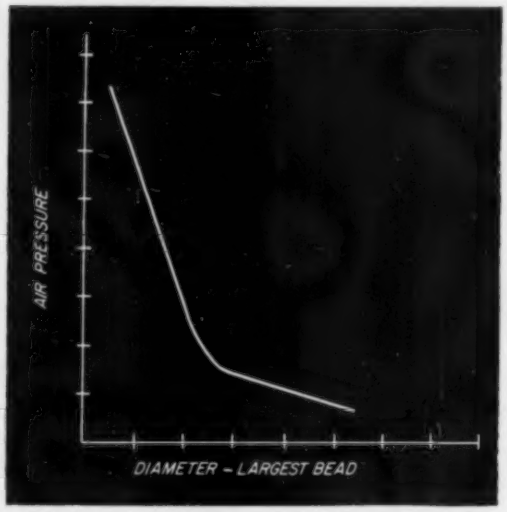


FIG. 3. CORRELATION OF AIR PRESSURE required to produce first bubble and diameter of largest bead which will pass through filter.

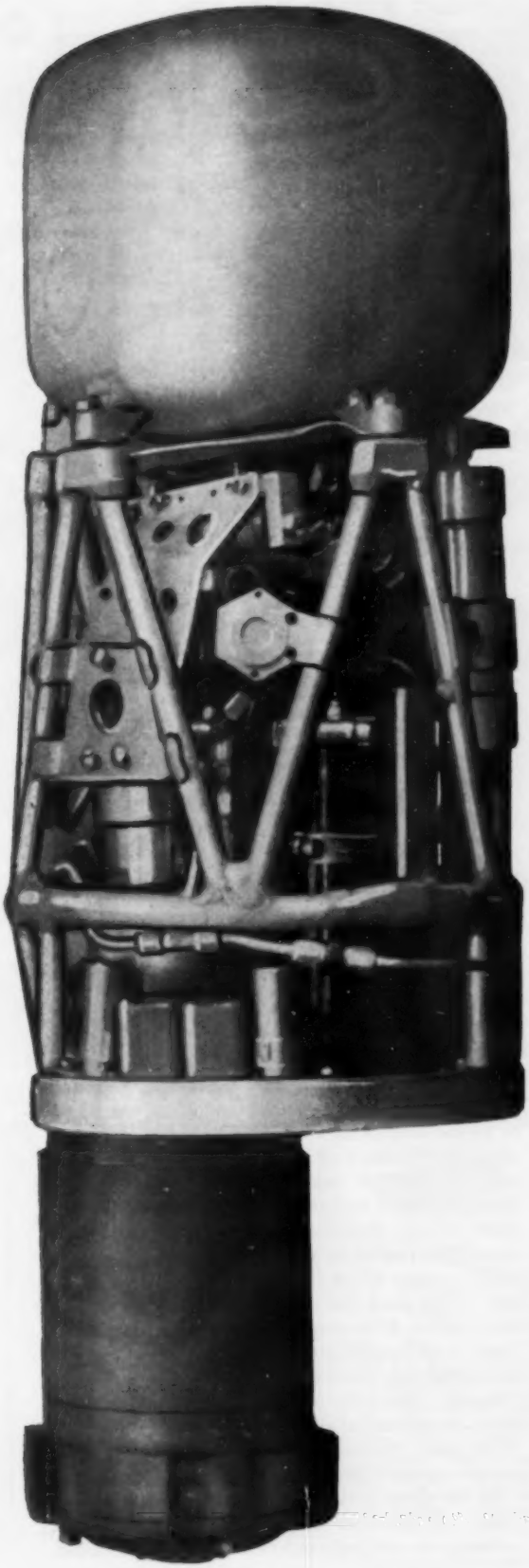
fluid which is then passed through the test filter. The filtered fluid is then centrifuged to separate remaining beads. The beads which have been separated are then examined microscopically. This approach permits measurement of the largest bead passed.

FILTER INSPECTION

Another question of extreme interest to all filter users is how can filters be checked on receipt to assure high quality? The filter manufacturers go to great lengths in their quality control methods to assure uniformity and consistency in their products. However, many airframe builders also check most of their procured items for quality, and filters should be no exception.

One very usable inspection technique is to measure the pressure drop across the filter. Assuming that the pores in the filter element are distributed in accordance with a normal probability curve, the pressure drop for any one design is a good measure of the mean pore size. However, this test does not give any measure of the distribution of the pore sizes about the mean.

Several filter manufacturers are now employing a simple inspection technique for measuring the all-important largest pore. This technique measures the pressure at which the first bubble appears when air



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pressure is applied across the filter while it is immersed just under the surface of a fluid. For any consistent filter medium this air pressure correlates quite well with the largest bead which will pass through the filter. Figure 3 is a plot of this correlation. Thus, a quick, simple measure of the maximum distribution of pores on the large side of the mean appears to be possible.

RECOMMENDATIONS

Adequate techniques for evaluating the capacity of filters now appear available. Some work might still be done to assure correlation between saturation methods using AC Test Dust and glass beads.

The most widely used methods for evaluating filter efficiency, with their advantages and drawbacks, are summarized in Table I.

Table I—Efficiency Evaluation Methods

	Advantages	Disadvantages
MIL-F-5504A	Wide range of particle sizes. Statistically non-uniform particle shape.	Tedious. Inaccurate.
Particle Count	Wide range of particle size. Non-uniform particles. Usable for any fineness rating.	Possibility of sampling errors. Tedious.
Glass Bead	Easy. Accurate. Reproducible.	Poor contaminant. representation. Does not measure pore size distribution. Not usable for ultra-fine filters.

The glass bead method of measuring filtration efficiency with, perhaps, some modifications seems to be the simplest of the several methods for evaluating the efficiency of 10 micron filters. Experience with the particle count technique indicates that the glass bead method may over-look the importance of pore distribution on the large side of the mean. One procedure which could be recommended for 10-micron filters would consist basically of the use of the glass bead method with a microscopic examination to determine the size and number of large beads passed by the filter. This method should include a very careful evaluation of the fritted entrapment filter with AC Test Dust or the use of a finer entrapment medium such as Millipore paper. If necessary, the range of bead sizes should be extended on the upper end.

In the absence of other testing materials in sizes below 10 microns, the particle count technique seems to be the only practical system for evaluat-

ing filtration fineness and efficiency for filters which are rated less than 10 microns. This technique is slower and more ponderous than the glass bead methods but does give answers for equipment in which glass beads are useless.

The problem of specifying quick, easy and non-destructive inspection tests appears to be solved by the use of both a pressure drop test and a first-bubble test. These tests are short, require simple equipment, and appear to give a good measure of the mean pore size and the maximum pore size respectively.

What of the future? Does it lie entirely with AC Test Dust? The use of Carbonyl iron powder and jeweler's rouge has been suggested. Perhaps measuring and weighing techniques are not the methods of tomorrow. Passing radioactive sized particles through the filter and measuring the efficiency with a Geiger counter would be a means worth considering. ▼▼▼

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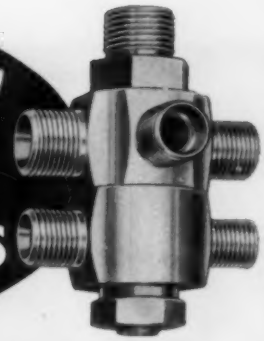

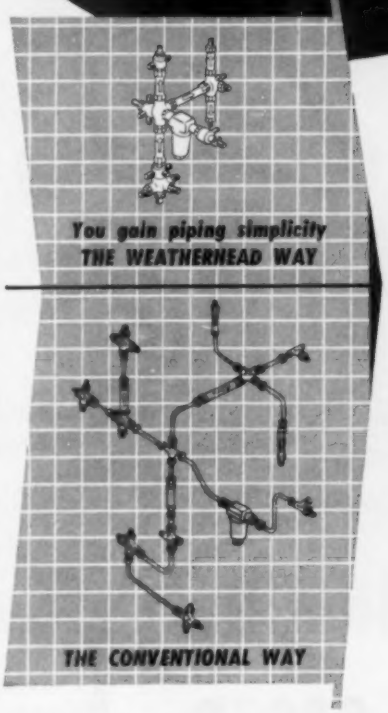

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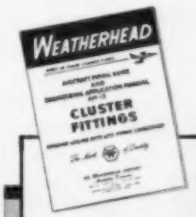

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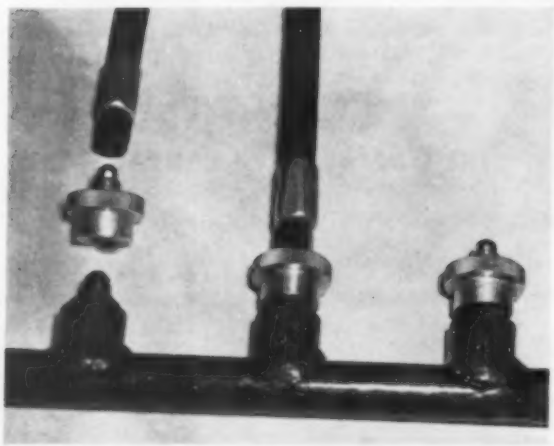

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● By F. Ecker

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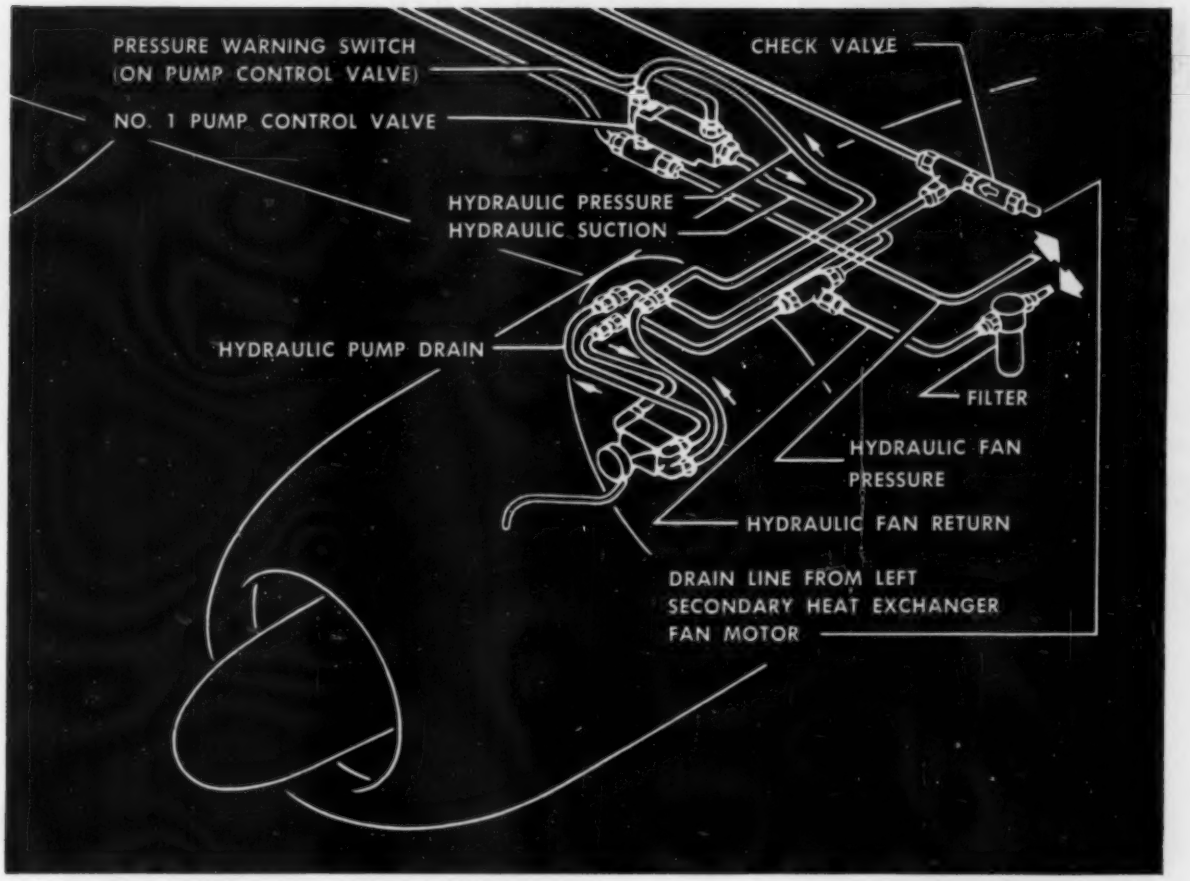
Under the old method each hose coupling nut had to be screwed onto the manifold and tightened with a wrench. Tightening 30 nuts (two per hose) took approximately 3 minutes per battery of 15 hoses.

With the new method, an adapter is placed on each fitting of the manifold. These adapters incorporate an O-ring on the end to which the hose is connected. Tightening the hose nuts by hand provides an adequate seal and eliminates the need of using a wrench.

New method saves time, cost, reduces operator fatigue, eliminates nut overtightening and results in less damage of cone seats. The O-ring adapter is commercially available in all sizes from —4 to —32. ▼▼▼

F. ECKER, *assistant supervisor, Fluid Test Section, The Glenn L. Martin Company, Baltimore, Maryland*



Where you can't afford a failure...
Plan a Purolator filter as part of your system

Most hydraulic systems break down immediately unless they are protected by adequate filtration. And it takes more than correct filter placement to assure adequate filtration — it takes the best filter you can get as well. That's why it pays to use Purolator Micronic® filters. They give you the fullest protection. The reason? Micronic elements — which provide controlled porosity and maximum filtration effectiveness with removal of particles as small as .000039 inch. And because they're made of plastic-impregnated cellulose, Purolator's Micronic elements are not affected by high temperature or water.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

To find out more about proper placing of filters in hydraulic systems, write for our new 32 page "Filtration Manual for Product Designers"—and please enclose 25¢ to cover postage and handling. Address Dept. P4-326.

SOLENOID VALVES

By
M.C. MFG. CO.

The one shown is:
MC 2644-1 VALVE—SHUT OFF SOLENOID OPERATED
fulfilling the following aircraft specifications:
FLUID: Air or Nitrogen
PRESSURE RANGE: 0 to 1500 psi
TEMPERATURE RANGE: —65°F to +160°F
FLOW FACTOR: F=.05
INTERNAL LEAKAGE: 10 cc/min. max. at 18 to 30 volt DC, 200 to 1500 psi inlet pressure
EXTERNAL LEAKAGE: Zero
SOLENOID: Continuous duty
Voltage range 18 to 30 volt DC
1.5 amps max. at 27 volt DC
PORT CONNECTIONS: Per AND 10050-4
WEIGHT: .9 lbs.
MILITARY SPECIFICATION: Applicable paragraphs of MIL-P-5518 and MIL-P-8564

Hydraulic and Pneumatic Components for the Aircraft Industry

VALVES OF ALL TYPES: Relief • Solenoid • Manual Control Transfer • Shuttle • Brake • Control • Fluid • Pressure Reducing Restrictor and Special

ALSO: Air Compressors • Fuel Pumps Dehydrators

M.C. MANUFACTURING CO.
118 INDIANWOOD ROAD
LAKE ORION, MICHIGAN

West Coast Office: 716 Wilshire Blvd. Santa Monica, Calif.

Representatives:
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P.O. Box 3107, Wichita, Kansas

L. YOUNGS
7520 12th., N.E., Seattle 15, Wash.

F. C. MINCH
1132 Donson Drive, Dayton 10, Ohio

New Products continued

HYDRAULIC VALVE
. . . used as flow divider

Designation: Series B-100
Features: Valves divide the flow equally between 2 cylinders which may have different loads. Made

with heavy, dense, homogenous cast iron body, and hardened and ground spool. Spool and body are mated by selective honing. Valve locks automatically when cylinder travel stops, preventing any transfer of oil from the heavy side to the lighter side. Flow return is rapid and will not slow down any gravity return operations.
Specifications: Available with ¼, ⅜ and ½ inch NPT ports. Suitable for service to 2000 psi.

Brand Hydraulics, Inc.
Omaha, Neb.

Circle 197 on Reader Service Card

FLEXIBLE COUPLING
. . . is radially removable

Designation: Type RRL
Features: Unit provides a simple means of disconnecting two units without axial movement of the shafts. This simplifies maintenance and is ideal for fluid power applications where driven equipment such as a pump, must be disconnected while the driving unit con-

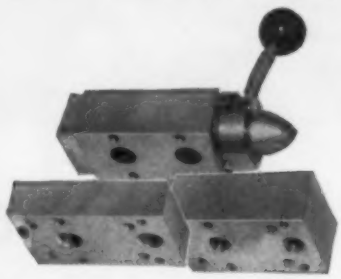
tinues to operate. It is only necessary to disassemble the coupling itself. Unit is rugged and simple. There is no wear on the metal jaws since the load is transmitted by compression of the one-piece load cushion.
Specifications: Horsepower ratings range from 7.5 to 40 at 1800 rpm. Bores are 1-⅜ to 2-¼ inches with ODs 2-9/16 to 5 inches. Overall length runs from 6-⅛ to 7-⅜ inches.

Lovejoy Flexible Coupling Company
Chicago, Ill.

Circle 198 on Reader Service Card

FLOW REGULATOR
. . . mounts on manifold

Designation: 1409 Series
Features: Adjustable flow regulator is adapted for manifold mounting. Subplate kits are furnished with built-in check valves for free reverse flow. Minimum to maximum flow adjustment can be obtained by 180 degree movement of the control handle. Unit is easily



adjustable. Handle hub contacts a friction disc which allows handle effort to vary to meet existing conditions.
Specifications: Either right or left hand rotation of control handle is available. Unit weighs 5 pounds, and all exterior aluminum surfaces are anodized. Flow rates from ½ to 12, or ½ to 20 gpm can be specified, at 3,000 psi.

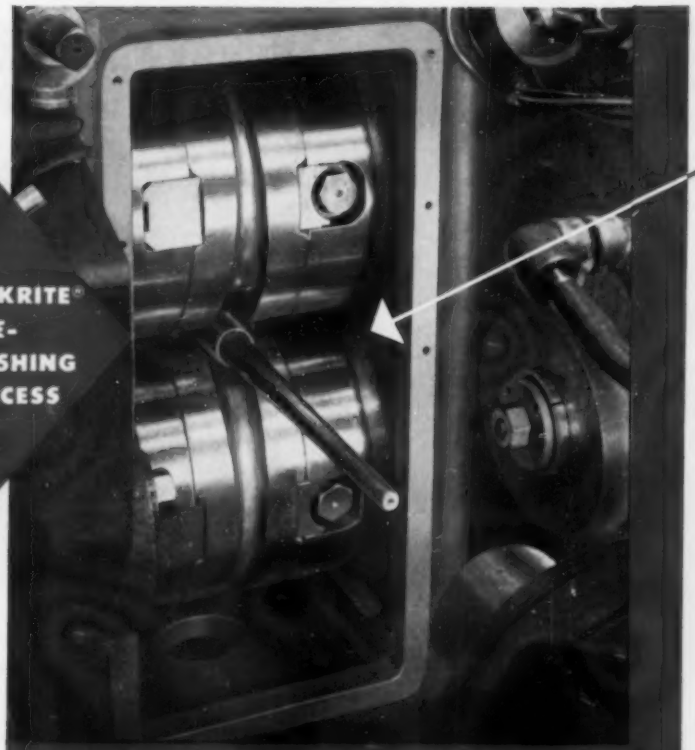
Waterman Engineering Company
Evanston, Ill.

Circle 199 on Reader Service Card

DOUBLE SPROCKETS
. . . offer fast mounting

Designation: Taper-Lock
Features: Double strand roller chain sprockets require no reboring or other machining for installation on shafts. Taper-Lock bushing enables users to mount sprockets and

Continued on page 138

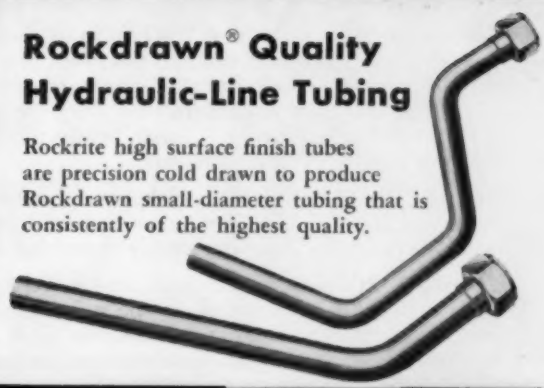


High quality begins here

This tube, leaving the Rockrite reducer, has been cold compression rolled—with great metal displacement. Result: Better structure of the metal, precision dimensions, and excellent surface finish. It is a quality tube.

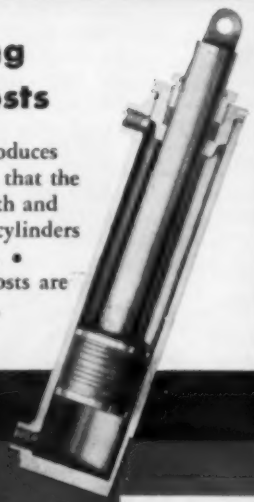
Rockdrawn® Quality Hydraulic-Line Tubing

Rockrite high surface finish tubes are precision cold drawn to produce Rockdrawn small-diameter tubing that is consistently of the highest quality.



Cylinder Tubing cuts honing costs

The Rockrite process produces such a high surface finish that the tubing can be cut to length and used as is for hydraulic cylinders with soft-packed pistons. • Machining and honing costs are always cut to a minimum.



Send for these bulletins.

PRECISION TUBING Rockrite Rockdrawn TUBE REDUCING CORP.

TUBE REDUCING CORPORATION
WALLINGTON, NEW JERSEY
New Jersey Tel: [illegible] • New York City Tel: CHickering 4-0877

the NEW

USG SOLFRUNT®

(SOLID FRONT CONSTRUCTION)

the gauge with

BUILT-IN SAFETY!

There's safety with the new USG Solfrunt Gauge . . . behind the face is a solid metal wall! In the event of a Bourdon tube rupture, pressure is released through the large rubber blowout back. The case is of aluminum.

Like USG's Supergauge . . . with proper application . . . the Solfrunt is built to last a lifetime.

ARC-LOC MOVEMENT—Rugged beyond compare . . . broad generated gear faces, deep stainless steel bushings. Calibration adjustments from rear by merely removing blowout back.

SEGMENT—Stainless steel, with nylon-faced gear section. Nylon-to-metal bond stabilizes the nylon against expansion and contraction . . . maintains accurate pitch diameter . . . assures proper mesh with stainless steel pinion under severe temperature and moisture conditions.

LEGEND ON DIAL—gives complete description of socket, Bourdon tube, and movement material for ready identification.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER—permits accurate repositioning of pointer.

Solfrunt Gauges available in 4½", 6" and 8½" sizes. For complete information on case styles, materials of construction and connections, write for Publication 1819.

UNITED STATES GAUGE

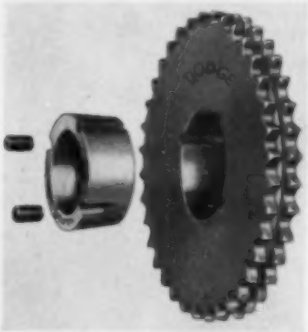
Division of American Machine and Metals, Inc.

Sellersville, Pa.

Home of the SUPERGAUGE

New Products / continued

bushings of the desired shaft size quickly and securely. Equivalent of shrunk-on fit is provided, whether shaft is turned and ground or cold-rolled, standard or normally undersized. Bushing can be reused. When sprocket becomes worn, only the tooth part needs to be replaced.



Specifications: Available in pitch sizes ranging from ½ to 1 inch, for use with standard precision chain conforming to ASA specifications. Hardened steel teeth are standard in sprockets up to 21 teeth.

Dodge Manufacturing Corporation
Mishawaka, Ind.

Circle 200 on Reader Service Card

FLARELESS FITTING TOOL . . . speeds pre-setting

Designation: Ferulset

Application: Designed for mounting in a vise, the tool expedites presetting of the fitting ferrule onto the metal tube in make-up of flareless type tube fittings. Wrench torque can be best applied in a vise.

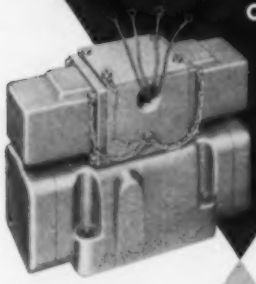
Reassembly of the fitting in final installation can then be effected with relatively little wrench action. For pre-setting work, the tool remains clamped in the vise instead of individually clamping each fitting body.

Continued on page 140

Circle 101 on Reader Service Card

LOOK To LOGAN

For POSITIVE HYDRAULIC CONTROL



Illustrated 9700 Series Solenoid Controlled Hydraulic Control Valve

Continuous-duty solenoids • Low power consumption • Dust-tight enclosures • Meets J.I.C. specifications • Full capacity thru-port and main spool • High-tensile alloy iron bodies • Internal or external pilot pressure and drain • Long-sealing surfaces • Open or closed center-type spools

WRITE FOR CATALOG 200—7

LOGANSPORT MACHINE CO., INC.
832 CENTER AVE., LOGANSPORT, INDIANA

Circle 116 on Reader Service Card

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾; Weight 30 lbs; Pressures: 0 to 125 psi; Price: $31.65 ea.; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.

Hamilton, Ohio

MODERN HYDRAULICS

demand

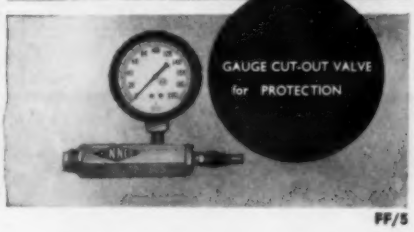
MODERN ANCILLARIES

Greer-Mercier Accumulators, offering power intensification, pressure storage, shock absorption, volume compensation, and surge elimination, are available in a variety of sizes to suit any modern hydraulic application.

FAWCETT FINNEY LIMITED

Finney Sensitive Pressure Switches provide a pressure range of 400—4,000 P.S.I. with pressure differential adjustable between 100—500P.S.I. For wide differentials two micro-switches are fitted.

This Cut-Out Valve automatically isolates recording instruments from pressure surges and offers complete protection within its pressure range of 50 to 4,000 P.S.I.



FAWCETT-FINNEY LIMITED

BERKLEY STREET BIRMINGHAM 1

Telephone: MIDLAND 3795 (3 lines) Cables: FINHYD BIRMINGHAM

A METAL INDUSTRIES GROUP COMPANY

PF/5

New Products continued

Specifications: Unit is made of hardened steel, in a range of sizes for fittings used with tubing, from ¼ through 2 inches outside diameter.

Parker Appliance Company
Tube & Hose Fittings Division
Cleveland, Ohio

Circle 201 on Reader Service Card

LOW PRESSURE VALVE
. . . for regulating air

Designation: Type 44
Features: Valve is single-seat, internal pilot-operated, piston-actuated, highly sensitive and responsive to slight changes in reduced pressure. Designed for steam service but should also provide good control of air. Strainers are easily removed for cleaning or replacement without removing the valve from the line.

Specifications: Maximum inlet pressure is 250 psi at 400 F. Delivery pressures range from 5 to 250 psi. Unit is also available with external sensing line. Sizes are 2, 2½, 3 and 4 inches, with iron body and flanged ends.

A. W. Cash Company
Decatur, Ill.

Circle 202 on Reader Service Card

TEMPERATURE SWITCH
. . . has remote control

Designation: E13
Design: Control is remote bulb type. The bulb is exposed to the controlled medium, and control head, with attached bellows, is the controlling device. A capillary tube connects the bulb and the bellows. Bulb, capillary tube, and bellows, are all liquid filled. Temperature change in the bulb is converted to volume change in the liquid, producing linear motion in the bellows plunger.

Features: Temperature settings are made by rotating the single-turn knob and pointer on the calibrated scale. A variety of bulb styles and capillary tube lengths are available although the standard length is 6 feet.
Specifications: Models are available with range spans of 100 or

Continued on page 142

GOSHEN
SPECIFICATION
COMPOUNDS

outstanding product advantages can be yours with elastomers custom-developed by Goshen Rubber

If it takes special compounding of natural, synthetic or silicone rubbers to develop the right combination of properties required by your part, depend on Goshen Rubber. Here you benefit from extensive knowledge gained in fabricating parts and compounding materials to meet MIL, AMS, SAE, ASTM and industrial specifications. Important recent Goshen developments include:
GORSIL silicone rubbers having same shrinkage as organic rubbers . . . useful over a temperature range of —80°F to +500°F. Dimensions and tolerances of AN, MS, SAE, JIC and NAS met consistently with standard tooling, and
GORSYN, synthetic rubber compounds (not silicones) withstanding temperature ranges of —65°F to +300°F, and—20°F to +400°F.
We'll gladly review and quote on your requirements, in confidence and without obligation.

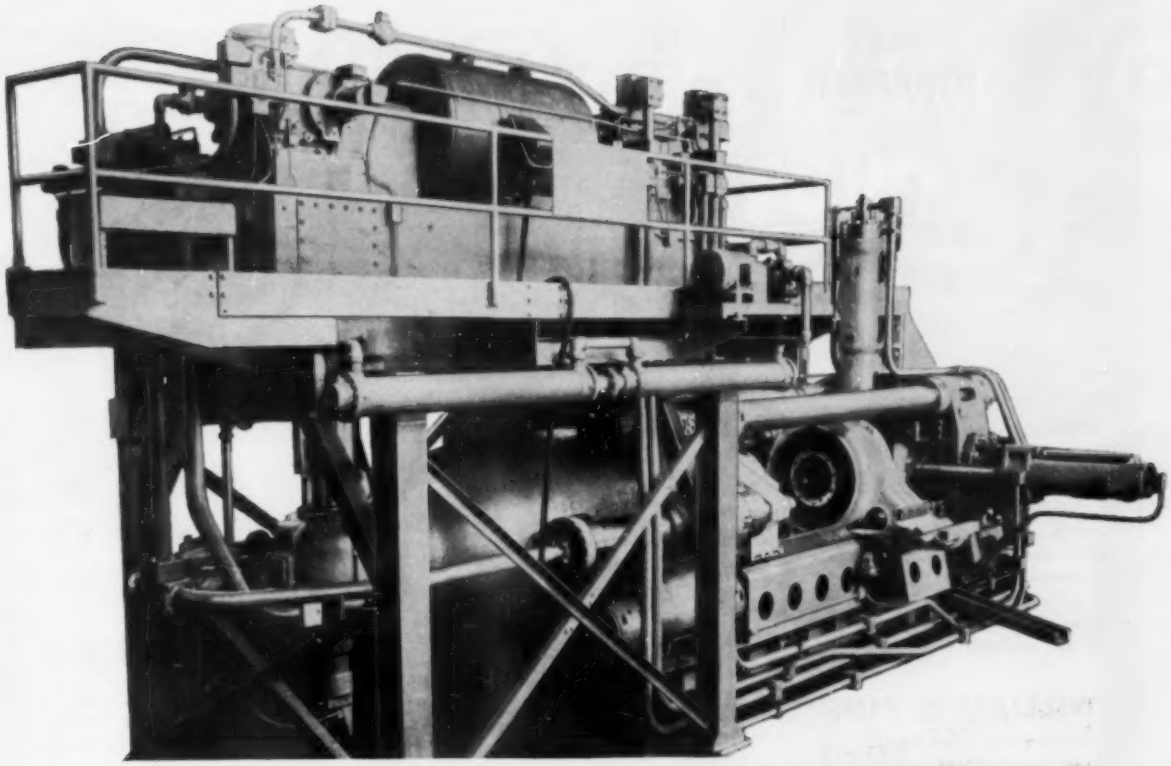
SEND FOR BROCHURE

This 8-page brochure, in handy file folder form, tells how you can put Goshen Rubber to work for you. Send for your free copy *today!*

See our catalog in Sweet's Product Design File.

PUT Goshen Rubber TO WORK FOR YOU

GOSHEN RUBBER CO., INC. 1337 S. TENTH ST. GOSHEN, IND.



SINCLAIR DURO HYDRAULIC OILS

give complete protection

Sinclair DURO Hydraulic Oils are designed for the exacting requirements of modern hydraulic systems – for higher pressures, higher operating speeds, and more sensitive, fully-automatic controls. DURO Oils contain high viscosity index Phetone Processed base oils plus 4 vital inhibitors to give *complete* protection. Here's how . . .

STOP RUST Sinclair's rust inhibitor has a preferential "metal wetting" action that permits the inhibitor to plate-out on metal surfaces and form a barrier resistant to penetration or washing away by water.

COMBAT OXIDATION Two specially-selected inhibitors provide *extra* resistance to formation of corrosive acidic materials, varnish and sludge. Sinclair DURO Oils actually exceed the oil specifications of leading turbine manufacturers.

RESIST FOAMING Sinclair DURO Oils contain a highly-effective anti-foam agent which protects against foaming in circulating systems – keeps foam-promoting air bubbles from being retained in suspension. You get smoother, *full-power* transmission.

For maximum performance at the higher temperatures, greater pressures, and faster speeds of modern hydraulic systems . . . switch to Sinclair DURO, the high viscosity index, fortified Hydraulic Oils. Contact your local Sinclair Representative, or write for a DURO product information pamphlet to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR DURO HYDRAULIC OILS

Circle 125 on Reader Service Card

HAND HYDRAULIC PUMPS

Single and Double Designs to 20,000 PSI With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches

Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE

Hydraulic Hand Pumps for 1001 Uses

1635 E. 22nd St., Los Angeles 11, Calif.

New Products continued

200 F, between limits of —150 and 650 F, and on-off differentials of 1 and 2 F. Units can be supplied with one of three standard switches: normally-open, normally-closed, or double-throw with no neutral position. Switches are snap-acting and can carry full process loads without relays. They also permit clean make and break without chattering.

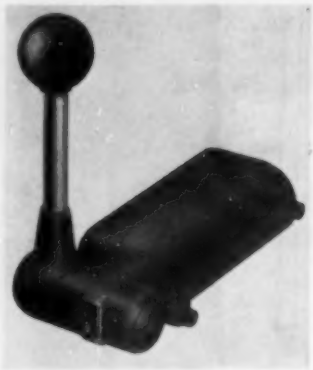
United Electric Controls Company
Watertown, Mass.

Circle 203 on Reader Service Card

3-WAY AIR VALVE . . . has graduated control

Designation: Model 2100

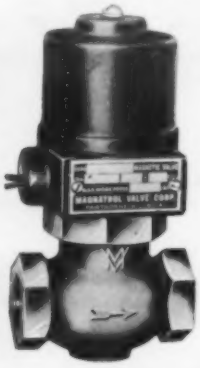
Features: This handle-operated, pressure regulator control valve should be useful in many applications—marine, industrial, construction equipment—in control of air cylinders, air clutches, and similar devices. Valve is compact and easily mounted. Two bolts fasten the working part to a manifold, and all air lines are connected to this manifold. Removal of the two bolts permits replacement or repair.



With only seven working parts, valve can be disassembled and assembled in minutes. Handle locks in any desired position by slightly twisting the knob, or springs back to neutral if brake is not applied.

Continued on page 145

Eliminate Costly Flow Failures



Magnatrol SOLENOID VALVES

Quick Operating Non Sticking Tight Seating

These three design advantages are your assurance against costly flow failures. Attain dependable, accurate, automatic or remote control of liquids or gases with **Magnatrol Valves.** Installed quickly and easily in connection with . . . flow-meters, thermostats, float and time switches. **Every Magnatrol Valve** is delivered to you—factory tested—guaranteed free from defects in material and workmanship.

Available in normally closed or normally open models. Pressure ranges from zero up to 300 PSI. Voltages to 575.

Catalog containing complete specifications mailed upon request.

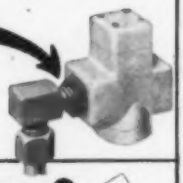
Magnatrol VALVE Corp.
HAWTHORNE 21
NEW JERSEY

Circle 104 on Reader Service Card

TRU-O-SEAL STOPS PIPE THREAD LEAKS

TEFLON SEAL

PAT. PENDING



Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ⅜", ten ½" pipe thread TRU-O-SEAL Fittings.

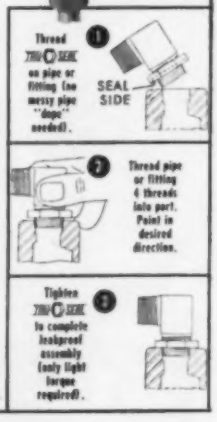
$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.

Send order to

TRU-O-SEAL DIVISION
Flick-Reedy Corporation

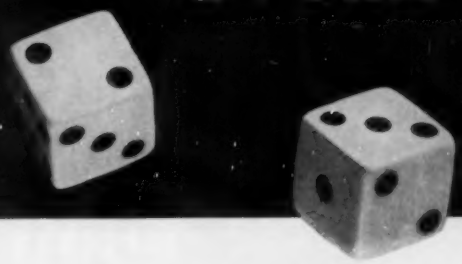
2008 N. Hawthorne • Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

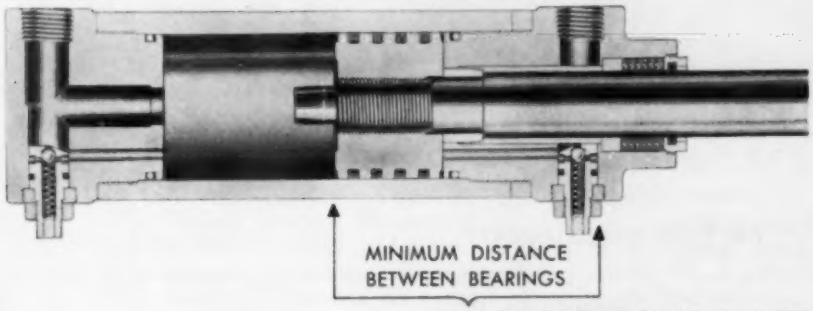

1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Circle 161 on Reader Service Card

We'd Like To Make a POINT...



ONLY Pathon HYDRAULIC CYLINDERS GIVE YOU ADEQUATE SPACE BETWEEN BEARING POINTS . . .



You Get These 5 Important Advantages:

1. Increased rod bearing life
2. Increased rod seal life
3. Reduced power eating friction
4. Eliminates rod cocking at end of out stroke, providing more rigid unit
5. Eliminates need for internal spacers
   This space allowed between the two bearing points keeps the unit loading on rod bearings to a minimum. While we do not recommend extreme side loading of hydraulic cylinders when this condition is unavoidable, Pathon cylinders are best.

Ψ could designate P. S. I.-102

Pathon MANUFACTURING CO.

WRITE TODAY FOR CATALOG
3823 PACIFIC AVENUE
CINCINNATI 12, OHIO

APPLIED HYDRAULICS *will devote the May issue to*

a progress report on

LEAKAGE CONTROL

CONTROL OF LEAKAGE—air and oil—is still the major problem confronting the designer of hydraulic and pneumatic powered equipment. Many dollars in lost fluid, horsepower and excess maintenance are being wasted. AH's editors have written and selected articles for May which give a progress report on leakage control . . . progress toward reduced costs and greater acceptance of fluid power.

SURVEY OF DESIGNERS . . . 700 designers of fluid power equipment were asked by AH editors to tell about their present experience with sealing devices and their success in controlling leakage. Lead article in May, based on this survey, gives a good picture of what machine designers and users are doing.

PROGRESS WITH PIPING . . . Articles will bring you up-to-date on acceptance of welded tubing for hydraulic systems; design and use of manifolds; installation techniques for hose and tubing.

PACKING DEVELOPMENTS . . . Five articles will discuss: fundamentals of packing operation, packing design for high pressure; application of Teflon for fluid power and installation methods.

PORT SEAL DESIGNS . . . Four types of port seal fittings will be analysed—straight thread with O-ring seal, straight thread with metal seal, sealing nut with pipe threaded Teflon insert, flanged fitting with O-ring seal.

NOTE TO ADVERTISERS . . . There will be extra distribution of the May issue at the Design Engineering Show, New York Coliseum, May 20-23. Your advertisement in the May issue will reach more than 30,000 men who specify fluid power components.

Closing Date for advertising: April 5th

APPLIED
HYDRAULICS

THE MAGAZINE OF FLUID POWER

812 Huron Road • Cleveland 15, Ohio

Specifications: Unit is completely of brass except for the plastic knob and chrome handle. Maximum pressure is 150 psi, with different pressure arrangements available. Various graduating springs can be furnished.

Valve Controls, Inc.
North Hollywood, Calif.

Circle 204 on Reader Service Card

PRESSURE REGULATORS
. . . offer close control

Designation: Series 20AG & 20-AG-X

Features: Precise control for air pressure over full operating range regardless of wide fluctuations in main line air pressure and widely varying air flow. Greater air capacity, balanced valve construction,

improved siphon tube action, greater effective diaphragm area hand-removable bottom plug for easier maintenance.

Specifications: Designed for use with water, oil and non-corrosive gases. Available in pipe sizes from ¼ through 1-inch. Model 20AG is the non-relieving type and 20AG-X has the relieving feature.

C. A. Norgen Company
Englewood, Colorado

Circle 205 on Reader Service Card

AIR FITTING
. . . allows separation at 3000 psi

Design: Unit can safely and quickly disconnect a pressurized line with pressures up to 3,000 psi. With the handle in upright posi-

Continued on next page

INEXPENSIVE—HIGHLY EFFICIENT

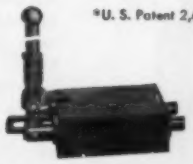
UNEQUALED FOR ⅛" AND ¼" SERVICE

• These valves combine utmost simplicity, low price and rugged, efficient, dependable construction. Valve chambers* are formed by aluminum spacers held tightly in metal to metal end abutment assuring accurate positioning of the "O" rings on both inside and outside diameters without mechanical pressure. The flow is from the inlet chamber through the hollow radially ported ground and polished stainless steel plunger, and out through other ports in the plunger to the connected line. No direct impingement of flow across the packings. No lapped joints. No metal to metal seating. Sub-base permits ⅛" or ¼" pipe connections into either side or bottom. Easily serviced in the field. Write for fully descriptive bulletin.

*U. S. Patent 2,645,450

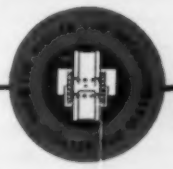
Ask us also about . . .

PILOT CYLINDER OPERATED HYDRAULIC VALVES suited for use with water or hydraulic oils up to 5,000 psi. 2-way, 3-way and 4-way actions. Sizes ½" through 4".



LEVER OPERATED HYDRAULIC VALVES suited for use with water or hydraulic oils up to 5,000 psi. 2-way, 3-way and 4-way actions. Sizes ½" through 1½".

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1994 East Pershing St., Salem, Ohio

Circle 81 on Reader Service Card

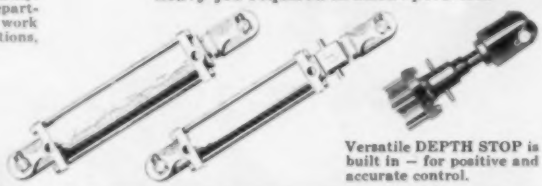
Circle 44 on Reader Service Card

ON THE JOB . . . WITH CROSS HYDRAULIC CYLINDERS

Rugged, dependable performance of CROSS HYDRAULIC CYLINDER is important feature of Pasture Dream Planter.

"The Cross Cylinder is an important part of our machine," writes J. E. Metts, assistant sales manager, TAYLOR MACHINE WORKS, Louisville, Miss. "Performance is highly satisfactory – well equal to the heavy job required in field operation."

ATTENTION: O. E. M.
We now offer immediate delivery on any quantity. Our Engineering Department will be glad to work with you on specifications, without charge.



Versatile DEPTH STOP is built in – for positive and accurate control.

HYDRAULIC CROSS MFG CO CYLINDERS

WRITE...WIRE...PHONE
CROSS MANUFACTURING CO.
LEWIS, KANSAS ■ PHONE 86

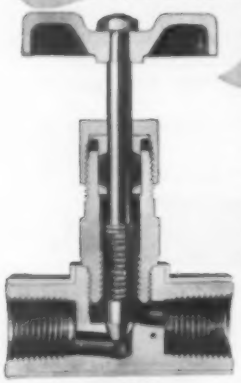
New Products / continued

tion, an integral, floating, ball-seat valve is fully open. To disconnect the line, the handle is rotated 90 degrees down. During this movement, the valve closes, and simultaneously, the pressure downstream

from the valve seal is automatically bled out, allowing the line to be separated without danger. Fitting at downstream end cannot be removed while the valve is in open position, and valve cannot be put into open position with the downstream fitting disengaged.

Continued on page 149

Now...the Marsh Needle Valve in 416 Stainless Steel throughout!



All the superior dependability of the Marsh Needle Valve . . . with all the corrosion resistance and durability of 416 Stainless Steel! Guaranteed for working pressure up to 10,000 psi; equally efficient at any lower pressure. Globe and angle patterns with double female connections in ¼" to 1" size range. Also globe and angle valves with male inlet, female outlet, ¼" and ½" sizes.

For complete details, write for Bulletin No. HV-2.

MARSH INSTRUMENT CO.
Sales Affiliate of Jas. P. Marsh Corp.
Dept. 19, Skokie, Illinois

MARSH
"THE STANDARD OF ACCURACY"

Marsh Instrument & Valve Co. (Can.) Ltd., 8407 103rd St., Edmonton, Alta., Can.

INSTANT PRESSURE REGULATION
0 to 3000 PSI

Proven Superior in Comparative Tests

WITH THE Futurecraft HI/LO HAND LOADER

Futurecraft CORPORATION
1717 N. Chico Ave. • El Monte, Calif.
WRITE TODAY for complete details

GENERAL SPECIFICATIONS	
Port Size	¼" tube per AND 10056
Pressures	Operating—100-3000 psi Proof—6000 psi Burst—7500 psi Minimum
Flow	Exceeds any other loader available
Operating Temperatures	– 65° to + 250°F
Weight	2½ pounds

Circle 106 on Reader Service Card

Circle 60 on Reader Service Card

NEW NICHOLSON *Model 300*

"4-way" control valve

Versatile flat-disc type valve is drop-tight . . . provides sensitive throttling action for a variety of rugged control applications.

If you need precise, repeatable control of double-acting cylinder-actuated mechanisms . . . you'll want to try this new advanced-design valve. Ruggedly constructed of a combination of corrosion-resistant materials, it can be used with air, water, gas and oil. Check its features, send for literature.

Send for your copy of new Bulletin 300 . . . for details on design, construction, sizes and applications.

Outstanding features:

- **Trapezoidal ports for modulated throttling.**
- **One-shot lubrication, reservoir in base.**
- **Leak-proof O-ring packing and seal.**
- **Easily adapted to single cylinder control.**
- **Low maintenance, easily disassembled.**
- **Simple, reversible mounting clamp and lugs.**

NICHOLSON

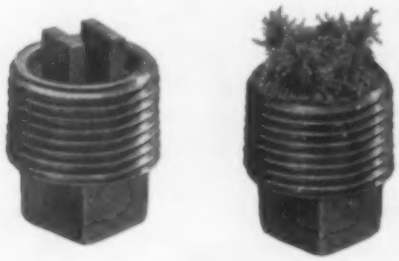
W. H. NICHOLSON *and Company*

VALVES • TRAPS • FLOATS • METAL PARTITIONS • LAUNDRY, DRY CLEANING, AND PRESSING MACHINERY • HOSPITAL CUBICLES

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES

HYDRAULIC SYSTEMS need LISLE *Magnetic* PLUGS

The *pump* in a hydraulic system will last *years longer* when you use *Lisle Magnetic Plugs*. The long-lasting powerful magnet in the Lisle plug pulls abrasive steel particles out of the fluid, thereby preventing their entrance into the pump and valves. Removal of these abrasive particles cuts down wear, assures longer, more efficient operation.



BEFORE AFTER

ENGINEERS . . . Write for free sample *Lisle Magnetic Plug* for testing. Please tell us the thread size you need. A complete catalog will be mailed to you without obligation.

LISLE Corporation

CLARINDA, IOWA

Circle 99 on Reader Service Card

Circle 132 on Reader Service Card

REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

What! PLUG VALVES THAT TURN EASILY AT 65° BELOW!! WITH NO LUBRICANT!!!

Up to 250°, down to −65° F, is the range of Republic's LO-TEMP selector valve. Easy turning, positive sealing, at pressures to 100 psi. Tapered TEF-LON plug requires no lubricant, and is not affected by acids or alkalis.

Aluminum body for aircraft and general use, stainless steel for chemical, food, and dairy industries. Angle, 2, 3, 4-way, with or without drain, flanged for panel mounting.

Write for Bulletin No. 754. Distributors in principal cities from coast to coast.

134

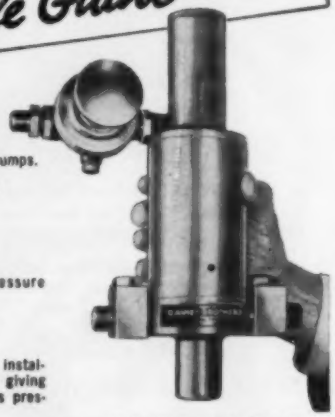
RM REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

8 reasons why you should switch to—

AIR-HYDRO-PUMP Jr. "The Little Giant"

FOR PRESSURE TESTING 10,000 PSI (with air-100 psi)



1. Operates more quickly and efficiently than hand pumps.
2. A turn of the wrist gives instant pressure.
3. Saves man hours.
4. Eliminates fatigue.
5. Maintains constant pressure without air consumption.
6. Ideal for testing valves and fittings.
7. Economical for multiple installation at test points, thus giving wide range of simultaneous pressures.
8. Ideal as source of hydraulic power for operating small presses, jacks, rams, clamping devices and other hydraulic mechanisms.

SIX JUNIOR MODELS
100 PSI TO 10,000 PSI

$185.00
F.O.B., N.Y.C.

Also Complete Range of 35 Standard Models, Single or Double Acting

DAVIES BROS. 120 WALL ST., N.Y. 5, N.Y.

Circle 47 on Reader Service Card

Features: Efficient high flow is obtained by straight-through flow path, with constant cross section area. Guaranteed zero leakage up to 3,000 psi. Ambient and operating temperatures from —65 to 200 F. Low torque operation for opening or closing against high pressures.
Specifications: Made of aluminum and stainless steel with Teflon seals. Available in right-angle or straight-through configuration in sizes ¼, ⅜ and ½ inch.

Hydromatics, Inc.
Cedar Grove, N. J.

Circle 206 on Reader Service Card

AIR COMPRESSORS
. . . are compact, lightweight

Designation: CT Series
Features: Units are compactly designed, fully air-cooled, in the medium capacity range, with low floor-space requirements, and are comparatively lightweight.

Specifications: 45-hp CT-4 model develops 175 cfm, and the 75 hp CT-6 delivers 340 cfm. Both models are two-stage, single-acting type, reaching rated capacity at only 970 rpm.

Compressor Division
Atlas Copco Pacific, Inc.
San Carlos, Calif.

Circle 207 on Reader Service Card

OIL PUMPS
. . . offer easy installation

Designation: OB
Features: Designed to handle hydraulic oils at pressures up to 300 psi, at 1800 rpm, with quiet operation, long life and efficiency. Special tooth form of the pumping elements reduces friction and provides positive pumping action. Mirror-lapped, nitroloy seal, flexibly held against dry-lubricated bronze

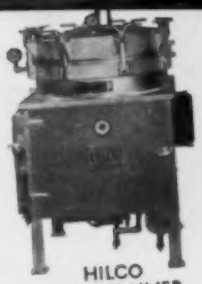
Continued on next page

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



HILCO OIL RECLAIMER
For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS Free BOOKLET

Recommendations at no Obligation

THE HILLIARD Corporation

148 W. FOURTH ST. • ELMIRA, NEW YORK

IN CANADA:

Circle 76 on Reader Service Card

New Products continued

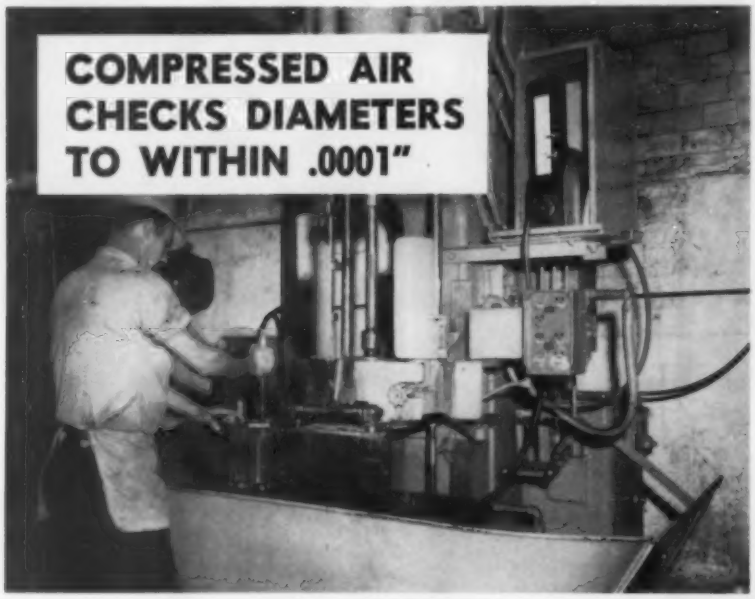
bushing, clamped to shaft, prevents leakage. Seal chamber is subjected to inlet pressure only. Design permits simple field replacement. Hardened and ground, large-diameter shaft has long, accurately fitted bearing, continually lubricated which increases pump life and permits pulley drive or direct coupling. Installation problems are simplified by two inlet and two outlet ports permitting connections on either side of the body. Unused ports can be used for installation of pressure and vacuum gauges.

Specifications: Units are precision-built, constant-volume pumps, available as standard units for prompt delivery, or can be engineered into

existing or new equipment. Where higher speeds up to 3600 rpm are needed, modified versions with special gearing are available.

Sundstrand Hydraulic Division
Sundstrand Machine Tool Co.
Rockford, Ill.

Circle 208 on Reader Service Card



Fast precision gaging with compressed air speeds work flow at this critical honing operation. The vertical hone for finishing cylinder walls is equipped with a Sheffield air gage for checking inside diameters, and the air is supplied by a Quincy Compressor. To measure various diameters, the operator has only to change gage plugs. Scale is highly visible, located out of the work area.

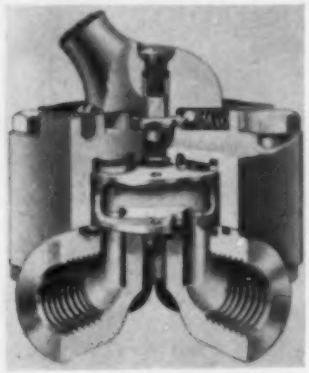
Just another example of how Quincy LOW COST AIR POWER can increase the efficiency of machines and manufacturing operations. Quincy makes compressors for industry from 1 to 90 C.F.M. For help with your compressed air applications, address Dept. AH-357.

Quincy COMPRESSORS

QUINCY COMPRESSOR CO. • QUINCY, ILLINOIS

AIR-OIL VALVE . . . is leakproof

Designation: Seal-Tite
Features: Unit gives leakproof service for air, hydraulic oil and water. Balanced pressure makes turning easy, yet dynamically loaded sealing rings, on opposing sides of the valving disc, seal tighter as pressure increases. Reversal of flow at any pressure, or zero pressure, will not unseat these seals.



Specifications: Working pressure for air is 500 psi; for liquids, 1,000 psi. Operating temperature range is —65 to 160 F. Originally available with closed-center valving disc, an added design offers open center, giving a wider range of applications. Mounting brackets, either straight or angle, make installation easy. Unit is made of cast aluminum alloy, anodized and side-ported, in sizes ⅛ to 1 inch.

Republic Manufacturing Company
Cleveland, Ohio

Circle 209 on Reader Service Card

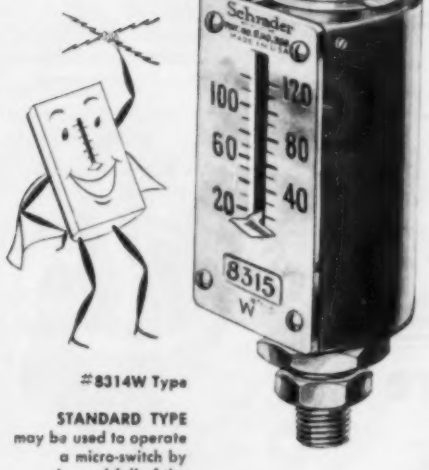
Continued on page 152

SCHRADER HYDRAULIC GAUGES DO THE JOB RIGHT...

keep accuracy under shock and overloads!

SHOCKPROOF HYDRAULIC PRESSURE GAUGES

are especially useful where space is limited. Engineered for long, hard use on all types of hydraulic machines. The Standard Gauges are industry's favorites.



#8314W Type

STANDARD TYPE may be used to operate a micro-switch by rise and fall of the plunger to start another sequence, etc.

#8854W Type

ENCLOSED TYPE has plastic face, and plunger is protected by a brass cap for extra protection under unusual dust and dirt conditions.

Shock 'em

Overload 'em

HYDRODIAL TYPE

SHOCKPROOF HYDRODIAL PRESSURE GAUGES

are completely enclosed units. Durable plastic face covers large, easy-to-read numerals that can be read from 50 feet. Easy to install and maintain.

Schrader Hydraulic Gauges give years of hard workhorse service. Famous shockproof Schrader hydraulic gauges are giving dependable service in thousands of plants of every description. The full line is built on the same rugged principle as other world-famous Schrader products. They operate on direct action, use the spring-loaded principle, and all replaceable parts are interchangeable. No special tools or skilled labor are needed for recalibration. All Schrader Hydraulic Gauges are available in nine standard pressure ratings up to 5000 psi. All have built-in snubbers.

Use the right gauge for the right job. Order Schrader by name from your supplier. Catalog data on request.

Schrader®
ESTABLISHED IN 1844

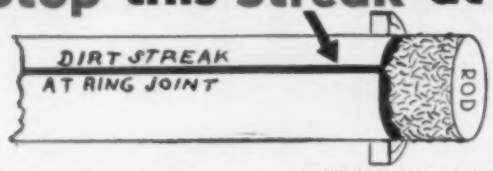
A. SCHRADER'S SON
A division of SCOVILL
456 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR

FOR INDUSTRIAL PRODUCTION AND CONTROL

Circle 1 on Reader Service Card

Stop this Streak at the Joint

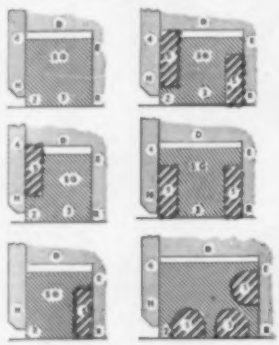


with a

Fall

CLOSED JOINT **WIPER RING**

Showing 6 of the many FALL "Closed Joint" Wiper Rings for Industrial Hydraulic and Air Use with "Squeeze Grip Action" on the piston rod.



RING DESCRIPTION
SG—"Squeeze Grip."
2—Front side of ring
3—Closed Joint is in Ring.
4—Flange (or plate) holds ring in cavity.
5—Rubber seal compressed in restricted area.
H—Inside dia. of flange at bevel end (see #4 above).
D—Depth of Cavity for holding ring.
E—I.D. of cavity for holding ring.
R—Ring I.D. and/or rod O. D.

Whether rods are actuated hydraulically or by air, always specify the FALL "CJ" Wiper Ring for the "cleanest wipe this side of shaving". Available in bronze or cast iron in diameters upward from ½", the FALL "CJ" Wiper Ring removes slightest accumulation of dust, dirt or other abrasives ON THE ENTIRE O. D. of the rod and also prevents passage through the joint itself. All Fall rings are spring loaded and the

SPRING LOADED **Endless Spring in O. D. of Ring Maintains Continuous Squeeze Grip on the Rod**

preventing ring from ever opening up, assuring "take up" of all wear automatically and eliminates build up of dirt under ring. Further, we factory lap each ring with our DRY-LAP process. This pre-actuating of the ring before packaging creates a "worn-in" true-circle which assures a "light tight" wiping edge immediately upon installation. Then by adding certain of our "rubber seal" features, all

SQUEEZE GRIP ACTION

DRY-LAP PROCESS **Moisture, Liquids are Sealed Out** SEALS OUT

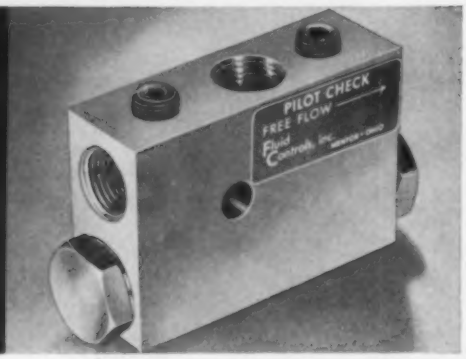
from entering bearings, bushings, etc., where possible damage may be done

We invite inquiries by letter, wire or phone. If you have a problem let us work with you in solving it.

Ace Products Co., Toledo 1, Ohio. PH: CHerry 3-6513
You Can Depend on ACE Products—Established 1935!

Prevent Leakage And Pressure Loss In Clamping Circuits

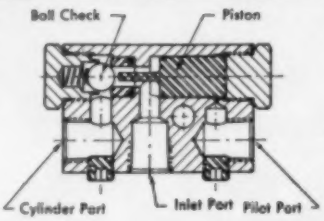
...With FLUID CONTROLS Reliable Pilot Check Valves



■ **CAN'T STICK OPEN**

- For oil to 3000 P.S.I.
- ¼", ⅜" & ½" Pipe Sizes

Write for detailed literature.



Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

Fluid Controls, inc.

1284 N. CENTER STREET • MENTOR, OHIO

New Products continued

AIR CONTROL VALVES . . . offer 210 models

Designation: Starline series.
Features: Five new pilot heads are interchangeable on 7 valve bodies, providing 35 major model combinations. Available pipe size increases the variety of combinations to 210 models.
Models: White Star valves have spool solenoid pilot head. Gold Star units are operated by a large-capacity pilot section actuated by an oil-immersed solenoid. Blue Star group includes all the remote-piloted, pressure-operated valves. Master valve gives immediate actuation and immediate reversal.

Specifications: The 7 valve bodies include straight way, normally-open and normally-closed; 3-way open and closed; all in the in-line series; 3-way, normally-open and normally-closed; and 4-way, all in the base-mounted series. Valves are built of corrosion-resistant materials.

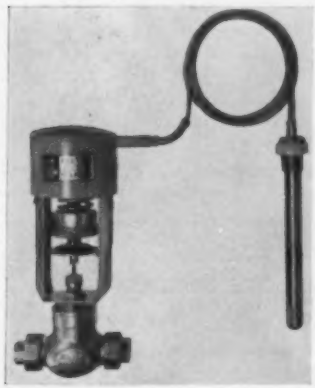
Ross Operating Valve Co.
Detroit, Mich.

Circle 210 on Reader Service Card

FLUID TEMPERATURE CONTROL . . . is self-powered

Designation: No. 997
Design: Contains large 4-⅜-inch bellows providing strong response and smooth modulating action. Unit is suitable for dead-end or terminal service as it has a tight-closing, single-seated valve.
Application: Controls flow of hot water, oil or other medium. Suitable for flow control of cooling water to transformers, internal combustion engines, air compressors and

hydraulic systems. Regulator closes automatically to prevent overheating and possible damage to products in process if thermostatic unit is damaged.



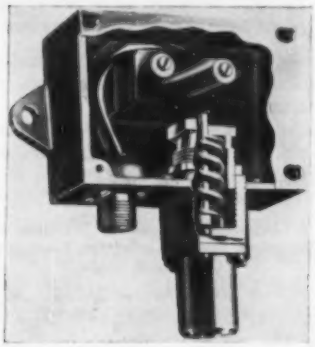
Specifications: Frame of regulator is heavy gauge stainless steel. Available in sizes from ¼ to 2 inches.

Fulton Sylphon Division
Robertshaw-Fulton Controls Co.
Knoxville, Tenn.

Circle 211 on Reader Service Card

AIR-OIL PRESSURE SWITCH
. . . features simple adjustment

Features: Hydraulic and pneumatic pressure switch operates from 0 to 1200 psi, withstanding 3000 psi without distorting its pressure element. Over its entire range, adjustments can be easily made without interfering with the pressure element.



Specifications: Unit is made of cast aluminum alloy, or stainless steel, and totally enclosed. It uses any limit switch, 15 amps, 120 to 460 volts AC, with single-pole, double-throw, silver contacts. Also available in DC. Switch can be arranged for wall or bracket mounting in any position.

Alloy Bellows Engineering Co.
Cleveland, Ohio

Circle 212 on Reader Service Card

Continued on next page

Seven-year survey shows experts still prefer **HYDRAMITE** Hydraulic Pumps for rugged applications

A survey of Hydraulic equipment users, made since 1950, reveals that when a constant displacement pump is needed, HYDRAMITE Hydraulic Pumps are still preferred because of their longer service life and greater endurance.

Nine basic features support the superior performance record of AECO HYDRAMITE Pumps:

- Cast-Steel Bodies
- High-Precision Bearings Throughout
- Liberally Sized Components
- Minimized Vibration
- All Parts Lubricated in Full-flooded Case
- Smooth Fluid Flow
- One-way Discharge with Either Rotation
- Quiet Operation Up to 5000 psi
- No Supercharging Needed

So, when the pressure's on your hydraulic operations, be sure you're equipped with AECO HYDRAMITE.

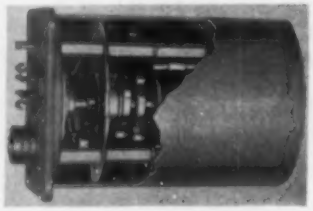
American Engineering Company

Dept. P-141 Wheatsheaf Lane & Sepviva St., Philadelphia 37, Pa.

Canadian Subsidiaries: Affiliated Engineering Corporations Ltd., Montreal, P. Q. - Bawden Industries Ltd., Toronto, Ont.

New Products continued

TIMER
. . . is small, light



Designation: Type 825
Features: Small, lightweight, hermetically sealed time delay relay meets all environmental requirements for aircraft and ground installations. A synchronous timing motor is used for 60 and 400 cycle applications. For DC, either a permanent magnet type or a governor controlled motor may be used, depending on accuracy requirements. **Specifications:** Available with from one to six contacts, with time cycles from fractional seconds to multiple hours, and provision for external timing adjustment. Unit weighs 30 ounces and measures 2⅜ x 2⅜ x 3 5/16 inches.

Eagle Signal Corporation
Moline, Ill.

Circle 213 on Reader Service Card

GAUGE PROTECTOR
. . . has fast response

Features: Diaphragm type unit is designed to protect gauges from pressure surges, and is specially suited to air or poisonous gas service. Protector has fast response to pressure changes and will automatically cut out the gauge and bypass the working media when line pressures rise above the spring set-

ting. External pressure adjusting control permits accurate pressure settings from 10 to 100 psi. **Specifications:** Units are constructed with corrosion-resistant brass bodies. Available with ¼ inch FPT port connections.

Superior Hydraulics Division
Superior Pipe Specialties Company
Cleveland, Ohio

Circle 214 on Reader Service Card

ALL-METAL OIL FILTER
. . . is self-cleaning

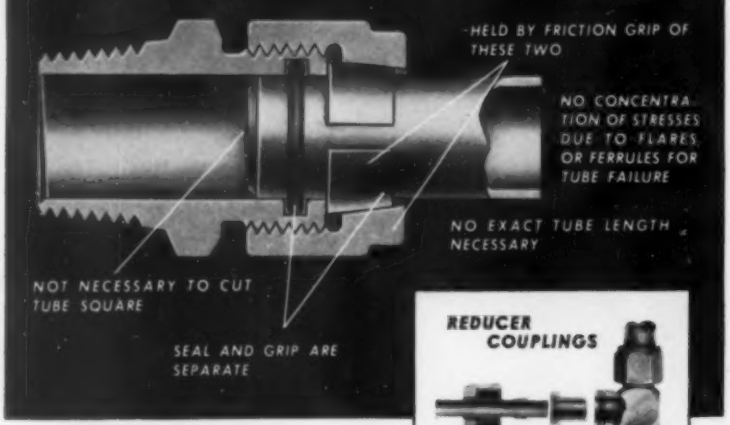
Designation: Super Auto-Klean
Features: Complete removal of all solid particles in the 50 micron range from a wide variety of fluids. All-metal construction prevents rupturing, channeling and contamination of the filtered fluid. Unit has high capacity for its size. With only 3 psi pressure drop, 350 gpm of lube oil at 200 SSU viscosity can

Continued on page 157

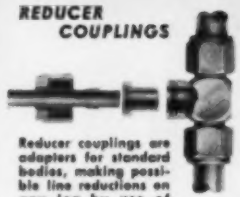
LENZ "O-RING"

NO METAL TO METAL SEAL

J.I.C. APPROVED


HELD BY FRICTION GRIP OF THESE TWO
NO CONCENTRATION OF STRESSES DUE TO FLARES, OR FERRULES FOR TUBE FAILURE
NO EXACT TUBE LENGTH NECESSARY
NOT NECESSARY TO CUT TUBE SQUARE
SEAL AND GRIP ARE SEPARATE

REDUCER COUPLINGS



Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

. . . A Hacksaw And A File Are All You Need

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collet holds by friction grip up to bursting pressure of tubing.

LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

LENZ COMPANY

See our Catalog Page in Thomas Register 1956 Edition, Vol. 1, under classification "Fittings: Hydraulic" for complete list of types and sizes.

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PHONE: ORegon 9364 • 3303 KLEPINGER ROAD

DISTRIBUTORS IN PRINCIPAL CITIES

Circle 95 on Reader Service Card

For quickest service in solenoid valves, write for Skinner's Nationwide Stock List

The Skinner Nationwide Stock List covers the most universally applied Skinner Solenoid Valves for air and hydraulic service. All the valves listed are carried by every Skinner Stocking Distributor in the U. S. From his stock, your own local distributor can quickly meet your requirements. So for your own convenience, we urge you to write for this nationwide stock list of Skinner Solenoid Valves.

Skinner Stocking Distributors are located in all key industrial areas. If you have a solenoid valve problem, talk to the one nearest you. Tell him your requirements in regard to port sizes and locations, voltages, pressures, temperature conditions, capacities and mountings. Let him show you how easily he can select the valve you need.

For complete information on Skinner's line of exceptionally long-life 2-, 3- and 4-way valves, write us or contact a Skinner representative. Write Dept. 313.

Skinner Solenoid Valves are distributed nationally

SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION

NEW BRITAIN CONNECTICUT

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for

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First Prize	$500
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All prize papers will be published in APPLIED HYDRAULICS Magazine. Papers receiving honorable mention awards will also be published during 1958 and paid for at regular rates.

CONTEST CLOSES JULY 1, 1957

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An Industrial Publishing Corp. Magazine

812 HURON ROAD

CLEVELAND 15, OHIO

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Chicago, Illinois

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Rockford, Illinois

A. J. DeMatteo, *General Manager*
Watson-Stillman Press Div.
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Roselle, New Jersey

TO RECEIVE A CONTEST RULES BOOKLET CIRCLE 320 ON READER SERVICE CARD

be put through the 5.7-inch element.

Specifications: Both motor-driven continuous cleaning and manual intermittent cleaning are available. Inline housing or integral mounting may be specified. Element is 5.7-inches diameter by 18 inches long.

Cuno Engineering Corporation
Meriden, Conn.

Circle 215 on Reader Service Card

GAUGE SAVER
. . . is fully adjustable

Design: Unit provides positive and automatic protection for hydraulic or pneumatic systems. When system pressure goes beyond the maximum operating limit of the gauge, the gauge is automatically shut off. The gauge is reconnected when

pressure drops within proper limits. A compression spring controls the shutoff point and may be adjusted to accommodate minor changes.

Specifications: Available with ¼ inch male tube inlet connection and ¼ inch male tube or ¼ inch female pipe outlet connection, in all shut-off pressures from 60 to 3000 psi. Units weigh 2 ounces, are 3 inches long, with an operating temperature range of —65 F to 160 F. Maximum operating pressure is 5,000 psi.

Fisher Controls, Inc.
Santa Monica, Calif.

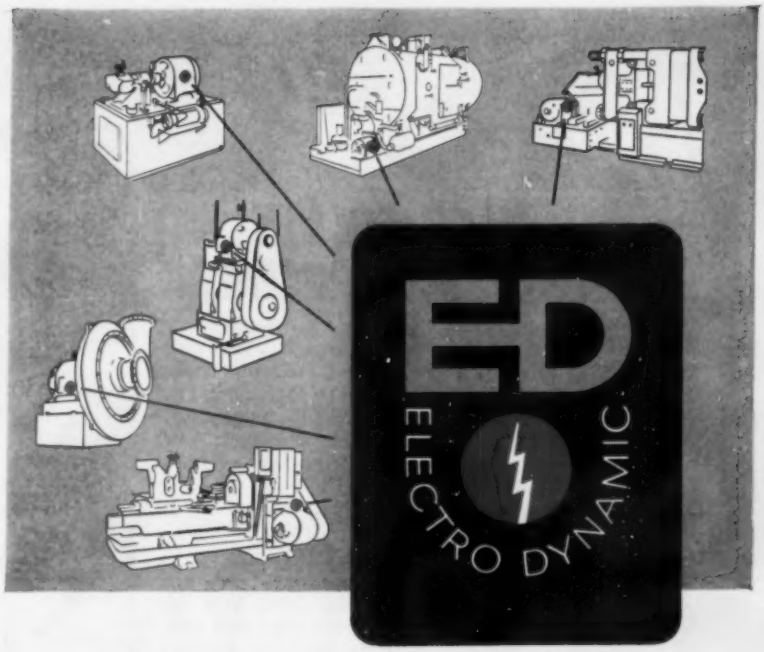
Circle 216 on Reader Service Card

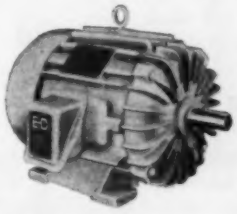
TEMPERATURE TEST CHAMBER
. . . tests —65 to 600 F

Designation: TC-4

Features: Designed for ambient testing of products from —65 to

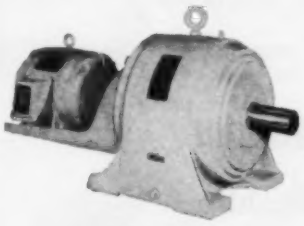
Continued on next page





STANDARD MOTORS

THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY



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The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.

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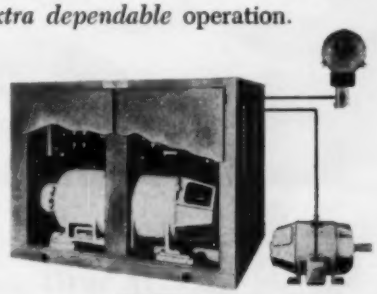

SELECTROL
VARIABLE-SPEED DRIVES

ED ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS
CORPORATION
BAYONNE, NEW JERSEY
GD GENERAL DYNAMICS

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Whether your problem is the right packings or perfect packings in quantity on time . . . turn your problem over to the experienced men who make Page Packings. You've created the equipment . . . worked out the major problems of design . . . now turn that troublesome packings problem over to specialists who have worked out similar problems thousands of times.
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Your problem is in good hands when you turn it over to the engineers at Page. They have the experience and the know-how, the spirit and willingness to cooperate, plus the integrity that has built a sound reputation for Page. They will work out the best packings for your special requirements, and give you honest recommendations.
Packings Engineered to do a Better Job
Page Packings are engineered to do a better job. With their wealth of experience, their laboratory and test facilities, and backed by a plant that can turn out thousands of packings a day, Page engineers will give you precisely built and finished packings in the right leather or synthetic to best do your job.
Write, wire or phone us about your problem . . . or for a quotation. Or ask for your copy of the helpful Page Manual.
PAGE BELTING COMPANY
Established 1868
Concord, New Hampshire
PAGE BELTING CO.
It will pay you to specify
PAGE PACKINGS
Engineered to do a better job

New Products / continued

600 F, unit has 600 cubic inches of working space. Additional interchangeable test trays permit continuous operation. Each test tray has fifteen, ⅜ inch diameter openings for electrical or mechanical connections to the product under test.

Construction: Unit is compact, portable, and requires no external accessories. Simple construction with quality materials assures high reliability. Anticipator-type thermostat limits maximum temperature fluctuations to less than 4 degrees.

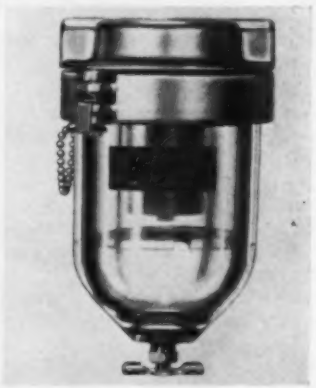
Statham Development Corporation
Los Angeles, Calif.

Circle 217 on Reader Service Card

AIR FILTER

. . . has small pressure drop

Designation: Series 30AE
Features: Filter is designed to improve operating efficiency, reduce maintenance and increase life of air-operated equipment. Moisture removal is efficient and pressure is



low. Hinged-type clamp rings have chained clamp pin to simplify servicing. Louver plates improve the centrifugal air flow pattern. Filter elements are large to produce a high degree of filtration.

C. A. Norgren Company
Englewood, Colorado

Circle 218 on Reader Service Card

Continued on page 160

Circle 69 on Reader Service Card

Announcing—

A NEW GRESEN VALVE

With FLOAT Position

GRESEN HYDRAULICS

A Two Spool Directional Control With Float

FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action—Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

Write for literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-37 Minneapolis 11, Minn.

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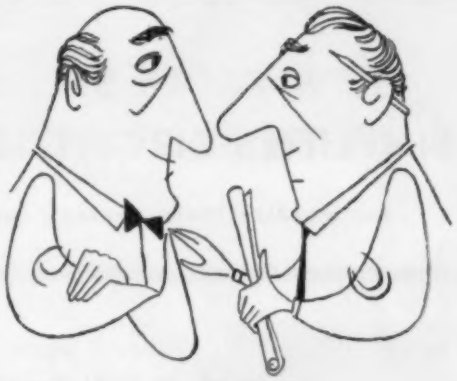

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Completely reliable testing of safety valves is assured with the I. E. C. Test Stand. Four gauges give accurate readings, in the model illustrated, for pressures ranging between zero and 1000 pounds. Models are available for any ranges selected by the customer up to 10,000 pounds pressure. Adapter plates can be furnished to fit all sizes and types of safety valves. For complete information, please write for Bulletin 545.

Reliability of the Safety Valve Test Stand is guaranteed by the well known repeatability and accuracy of I.E.C. Gage Gards. They prevent the pressure being measured by each pressure gauge from exceeding its maximum.

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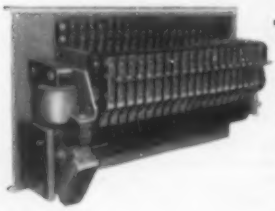
MANUFACTURERS OF
INDUSTRIAL PISTON RINGS FOR HIGH COMPRESSION SERVICE

Circle 85 on Reader Service Card

Circle 70 on Reader Service Card

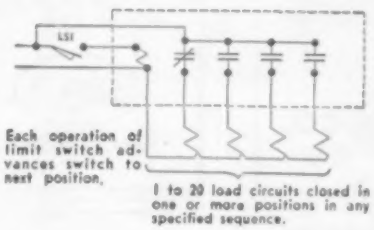
NEW EAGLE STEP SWITCH SIMPLIFIES CIRCUIT SEQUENCING

. . . for machine tools, presses, conveyors, processes

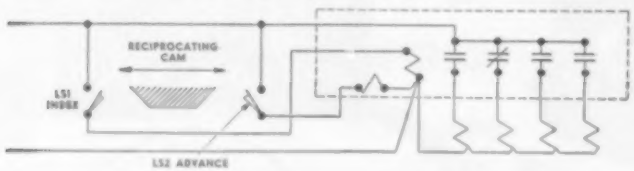


These 3 basic ideas are yours for simplified interlocking or sequencing of multiple load circuits. Any and all three will eliminate many other electrical components, and cut your initial cost.

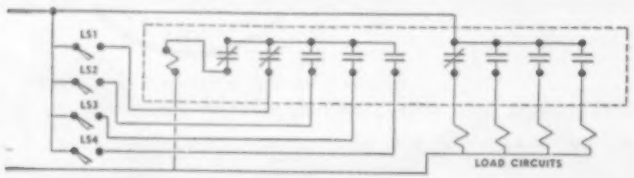
Operating load circuits in sequence: A limit switch on a machine or indexing device closes and opens upon each operation to advance the Eagle step switch. Or a timer may be used to operate each load circuit for a predetermined time.


LS1
Each operation of limit switch advances switch to next position.
1 to 20 load circuits closed in one or more positions in any specified sequence.

Interlock sequence: *Two limit switches* are operated alternately. This provides a safety feature. It insures that the movement of the machine has been completed before the Eagle step switch advances.



Interlock sequence with several limit switches: Each limit switch advances the Eagle step switch one position. Switches must operate in sequence or the step switch won't advance.

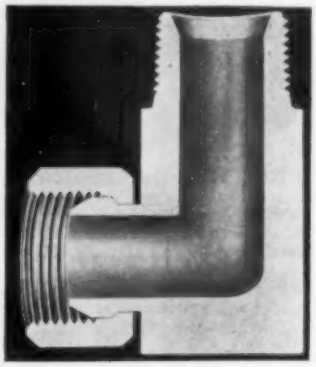


Send for new Eagle Bulletin 850. Simply write to Eagle Signal Corporation, Industrial Timers Division, Moline, Illinois, Dept. AH-357.

New Products / continued

ADAPTOR UNION
. . . eliminates turbulence

Designation: TF
Features: Unit has completely rounded inner bore providing an entirely smooth radius to all angles Turbulence and friction are eliminated, reducing heat and pressure



loss and improving efficiency. Male ends are tapered to eliminate any shoulder at juncture of adjacent fitting, facilitating fluid flow.
Specifications: Available in 45 and 90 degree adaptor unions.

Eastman Mfg. Co.
Manitowoc, Wis.

Circle 219 on Reader Service Card

RING SEAL
. . . eliminates spiral twist

Designation: Quad-Ring
Features: Seals have no parting line on sealing edges, eliminating spiral twist failures, rolling with pulsating pressures, and leakage at low pressure differentials. Seal is effective in reciprocating, rotary and static installations.

For convenience of fluid power engineers, a special ruler is available for the asking. Five available cross sections—.070, .103, .139, .210 and .275—are cut out of clear styrene plastic to true size and contour.

Minnesota Rubber & Gasket Co.
Minneapolis, Minn.

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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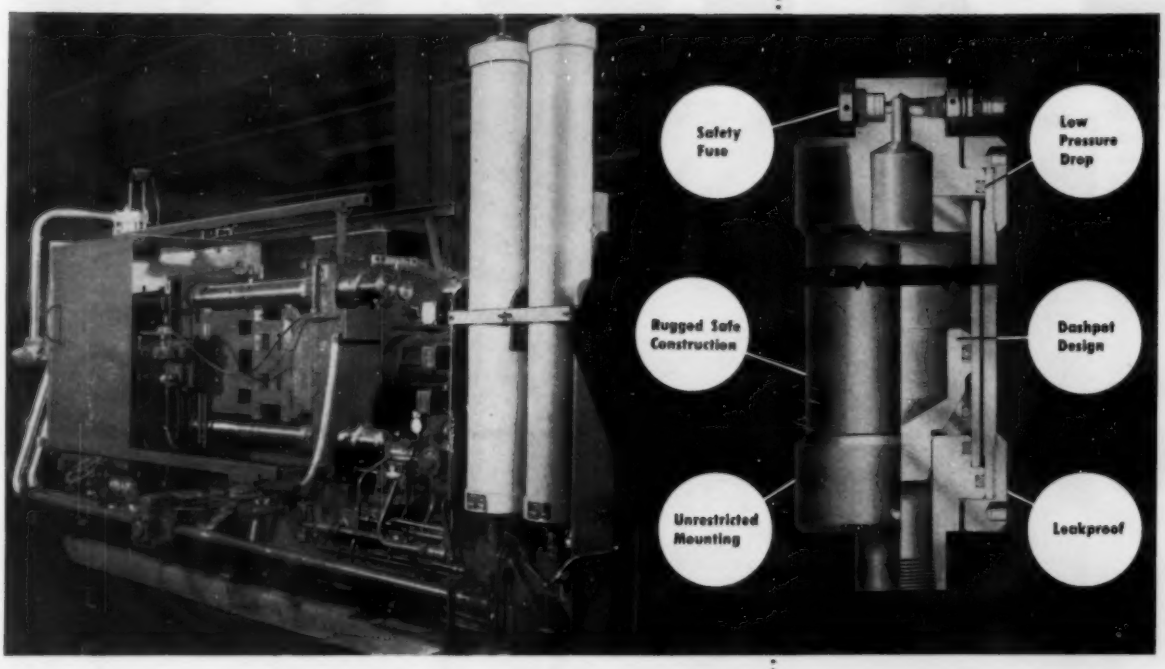
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

Super-Hy Accumulators help Cast-Master Die Casting Machines operate more efficiently and economically

Superior Accumulators

- Control shock and pressure surges
- Compensate automatically for pressure and volume
- Insure longer machine life
- Reduce machine downtime and maintenance costs.



■ To provide high injection speeds, fast cycling, and high steady pressures for the production of dense solid castings, two Superior Accumulators are used on the Model 20-Z Cast-Master Die Casting Machine. Installation of Superior Accumulators assure safe, dependable operation and permit the reduction in size and complexity of the machine. Use of the Superior piston type accumulators simplifies hydraulic system design and installation, provides a constant pressure, compensates for fluid leakage, eliminates shock and surges, and prevents nitrogen loss.

Each Superior Accumulator is pre-engineered to meet specific operating requirements. Check these features: Safety Fuse releases excessive gas pressure; Dashpot Design eliminates piston shock loads and hammering; Unlimited mounting facilitates easy installation; Floating Piston Type Separator; Low Pressure Drop; Large Selection to meet requirements up to 5,000 p.s.i., from 5 to 4,030 cu. in. net gas volume, from 3 to 3,465 cu. in. max. oil working volume.

Write for detailed literature and prices.

Superior Hydraulics Division

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...about air valves!

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10030 Capital, Oak Park, Detroit 37, Michigan

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MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., TWinbrook 2-2629
FLINT—Kober Sales Engineering Co., 1115 Root St., CEdar 2-7165
WESTERN MICHIGAN—Everett Adams, 17212 Sharon Road, Chesaning, Michigan, Chesaning 383-J-1

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FEderal 9-5579
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., Midway 4-2791

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ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 6, St. Ann, HArrison 8-4488

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OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, ADams 5-3366
TOLEDO 4—The R. W. Nichols Co., 510 Manhattan Building, CHerry 1-1447

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., CApitol 3-0205

PENNSYLVANIA
PHILADELPHIA—Grand Air-Hydro Co., P.O. Box 141, Glenside, TUrner 7-4296
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050

TEXAS
DALLAS 18—Womack Machine Supply Co., Shea Rd. at 7150 Harry Hines, FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

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MILWAUKEE 17—Neff Engineering Co., 5856 N. Pt. Washington Rd., EDgewood 2-1579

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Useful Literature continued

HYDRAULIC HOSE FITTINGS . . . reusable, non-skiving type, for rubber covered double wire braid hose for high pressure service, are described in Catalog 4433 available from Parker Appliance Company's Tube & Hose Fittings Division. With these fittings, hose cover need not be stripped off. Available with four different connecting ends; swivel nut for mating with 37° flare end connector, male pipe thread, straight thread with O-Ring, and 37° flare nose. Sizes range from 3/16 through 2 inches OD.

Circle 259 on Reader Service Card

AIR VALVES . . . for all types of applications are described in catalog V-103 published by The A. K. Allen Co. Complete, illustrated technical data is given on 3-way and 4-way valves. Types of operation include manual, pilot, cam and single or double solenoid. Bleeder, check, leak and flow control valves are also covered.

Circle 260 on Reader Service Card

NEOPRENE FACTS . . . useful to fluid power engineers, are given in the Neoprene Notebook published by the Elastomers Division of E. I. du Pont de Nemours & Company, Inc. This December issue covers the simulated service test for purchasing specifications. Also covered are: description of neoprene products used to replace metal springs, shipboard uses of neoprene in the Navy, neoprene diaphragms in oil-field emulsion treaters and neoprene for fire hose.

Circle 261 on Reader Service Card

SOCKET HEAD SCREWS . . . with large head diameters are described and listed in a 4-page folder published by Cleveland Cap Screw Company. Stronger assembly of large components is possible with increased head diameters of large socket head cap screws. The larger head diameters on 1-1/8-inch to 3-inch screws provide greater bearing surface for higher torquing and insure a stronger assembly. Socket dimensions across flats have also been increased. Folder compares new head details with older, smaller head dimensions and details the range of physical properties in both coarse and fine threads.

Circle 262 on Reader Service Card

TUBE FITTINGS . . . manufactured by The Weatherhead Company's Fort Wayne Division, are covered in their 48-page steel tube and fittings catalog. Complete engineering data is given on Ermeto

hydraulic flareless tube fittings and Flare-Twin SAE 37 degree flare JIC hydraulic tube fittings. A section is devoted to assembly instructions, materials, finishes and operating pressures.

Circle 263 on Reader Service Card

VINYL HOSE . . . for pneumatic service is illustrated and described in 8-page catalog released by Hofman Engineering Company. Booklet shows various applications and advantages of vinyl hose in industrial applications. Information is also included on their line of filters, regulators and lubricators.

Circle 264 on Reader Service Card

FLUID POWER DEVICES . . . for air and hydraulic applications of all types, are described in 20-page catalog released by Modernair Corporation. Technical data and il-

Continued on next page

Circle 17 on Reader Service Card

For... the GREATEST POSSIBLE COMPRESSION

USE THE NEW AUTO-DIESEL GAPLESS PISTON RING

1. REDUCES AIR OR OIL LEAKAGE.
2. LOWERS THE COST OF COMPRESSED AIR.
3. YOU GET A MORE POSITIVE STROKE.

These are the 3 important advantages provided by the new Auto-Diesel GAPLESS Piston Ring. The patented insert is a new method of sealing and it positively prevents blow bys and the loss of compression. Can be used in pneumatic and normal pressure hydraulic equipment—will do a better job and last longer.

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"RINGS and SHAPES Since 1921"

Useful Literature

continued

lustrations are given for air and oil cylinders, air-hydraulic cylinders, hydraulic checking cylinders, valves, and packaged power units.

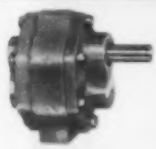
Circle 265 on Reader Service Card

SPROCKETS . . . with shear pin protection are available from stock at Link-Belt Company. Folder 2749 gives detailed information and tables listing stock sizes, torque ratings, hub dimensions, and keyseats. Examples for selection and problem-and-solution instructions are detailed.

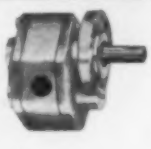
Circle 266 on Reader Service Card

GASKETS AND SHIMS . . . color-coded for quick selection of correct gauge of a gasket, shim, spacer or washer, are covered in folder available from General Gasket, Inc. In this system, each gauge has its own distinctive color. Folder describes Color-Plast, a plastic material, and lists its time and

Continued on page 166



S SERIES PUMPS



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HYDRAULIC PUMPS
MOTORS (ROTARY)
VALVES
CYLINDERS
PUMP AND VALVE COMBINATIONS

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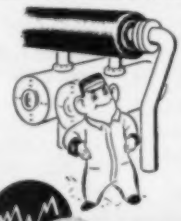

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Circle 29 on Reader Service Card

Circle 6 on Reader Service Card

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If you've been using 1" or larger bore cylinders for those applications in which you wanted the "smallest" bore, here are some of the benefits you'll derive from the new AIROYAL ⅝" bore cylinder: more compact size; reduced thrust from a given pressure; lower piston and rod inertia; increased velocity from a given flow input.

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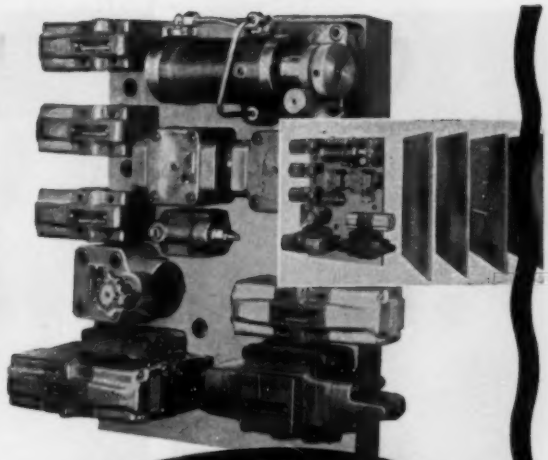

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CONTROL SYSTEMS READY FOR OPERATION — NO CIRCUITS TO PONDER OVER AT INSTALLATION

Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal—No obligation.

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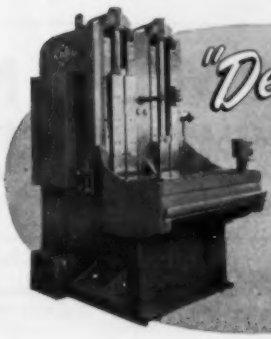

"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

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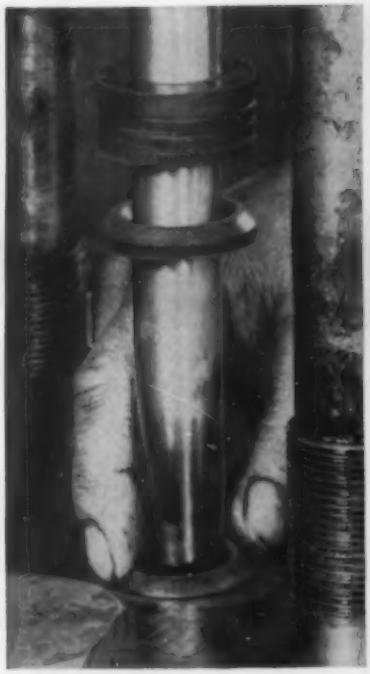

Can you pick the rings with the original Vee-Flex design?

Appearance won't tell—performance will!

DESIGNED FOR EVERY PISTON AND ROD • ROCK-HARD RINGS • POLYMER SATURATED FABRIC • PRECISION TRIMMING • PROPER INTERFERENCE FOR AUTOMATIC SEALING

R/M Vee-Flex is the original convex-design hydraulic V-ring—self-sealing, self-adjusting. Each ring is convex where it touches the shoulder of the next ring. On the pressure stroke an automatic flexing action occurs, producing a positive seal against shaft and stuffing box wall and against the next ring.

In precision molded R/M Vee-Flex, polymer penetration of the fabric is thorough and deep. This, plus rock-hard adapter rings, enables Vee-Flex to withstand in excess of 6000 psi without extruding. It also stops destructive wicking action.

Specify tough, positive-sealing R/M Vee-Flex Packing for long, trouble-free service on all your piston and rod applications. For complete data, write for the R/M Vee-Flex Bulletin.

R/M makes a complete line of mechanical packings — including Vee-Flex, Vee-Square, Universal Plastic, and "versi-pak"®; Gasket Materials, "Teflon"* Products.

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Useful Literature / continued

labor saving applications. Material is available as custom cut gaskets, shims, spacers, and in roll or sheet form. It is dimensionally stable, tear-resistant, requires no cement.

Circle 267 on Reader Service Card

HYDRAULIC COMPONENTS . . . available from stock are listed in Groban Supply Company's 60-page catalog for 1957. There are many illustrated pages on the application and installation of hydraulic power, and ideas on modernization of equipment. Listings include hydraulic motors, pumps, valves, cylinders and other equipment.

Circle 268 on Reader Service Card

WATER VALVES . . . for low pressure applications are illustrated and described in bulletin released by Tru-Flate, Inc. There are many uses in industrial installations for these quick-acting, flexible or rigid spout water valves. Adaptors are available for converting air hose to water lines.

Circle 269 on Reader Service Card

AIR COMPRESSORS . . . from 1/3 to 20 hp are listed and described in 20-page catalog published by The Kellogg Division, American Brake Shoe Company. Booklet is illustrated and gives complete specifications on single and two-stage models, portable units, tanks, pumps, and accessories. Useful charts, data and information on compressed air are also included.

Circle 270 on Reader Service Card

HYDRAULIC PUMPS . . . are described in a 4-page bulletin No. 46601-B issued by The Oilgear Company. These fluid power pumps are continuous pressure, constant displacement, heavy duty types. Purolator-type micronic filters are available for 100 percent filtration of the hydraulic fluid prior to entry into the high-pressure, axial piston end of the pump. Complete specifications are given on the units which are 3 to 10 hp, 1 to 5 gpm, 3,000 to 5,000 psi.

Circle 271 on Reader Service Card

SILICONE RUBBER COMPOUNDS . . . offering heat resistance and low shrinkage, are available from Acushnet Process Company for the fluid power industry. Higher service temperatures up to 600 F for intermittent periods for molded silicone parts are possible through the use of the five new heat resistant types, ranging from 40 through 80 Shore A hardness. Low shrinkage characteristics permit holding close tolerances in existing tooling originally designed for organic rubbers. Compression set is low in this group. A 10-page brochure is available.

Circle 272 on Reader Service Card

STEEL CYLINDERS . . . lightweight for high and low pressure fluid power applications, are described in 8-page booklet released by Walter Kidde & Company, Inc. Brochure gives specifications of 55 standard containers with capacities from 8.6 to 855 cubic inches, and service pressures from 300 to 3,000 psi. Methods of cylinder production, inspection and hydrostatic testing are also outlined.

Circle 273 on Reader Service Card

Continued on next page

Circle 13 on Reader Service Card

SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

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CROWN HYDRA-TROL
Remote Control

- Has positive stroke in both directions.
- Does not depend on spring return or outside power sources.
- Immediate synchronization of system in either direction.
- Is a self-contained hydraulic system for positive positioning of remotely-located levers, shafts, and other equipment.
- Valuable in controlling hydraulic valves, winches, throttles, slitting machines, butterfly valves, etc.

Write for bulletin A describing the control and showing its many uses.

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Circle 159 on Reader Service Card

280 SERIES METERING VALVES for precise control

20 TURNS moves the stem only 3/8"

For precision flow control use this brass bar stock metering valve, equipped with an O-ring stem seal. The extra long, sharp, needle point stem (8° included angle) and fine spindle threads insure accurate control for pneumatic or hydraulic service, or precision laboratory work. In ⅛" and ¼" pipe sizes. Your choice of 1/16" or ⅛" orifices. Available for Panel Mounting, too.

For complete information send for Bulletin No. BSV 256.

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Circle 77 on Reader Service Card

Useful Literature continued

AIR DRYER . . . desiccant type, for use in instrument lines, is manufactured by King Engineering Corporation. Unit is designed for removing water vapor from compressed gases serving liquid level gauges, air valves and other pneumatic equipment on dead-end or low-flow service in remote locations. It provides a dew point of —60 F or lower; can be used at a gauge pressure of 100 psi, and has a capacity of 60 scfh at 70 F. Unit consists of a head, case, and desiccant cartridge. The head is mounted straight through in the line, and need not be removed for servicing. The case, containing the cartridge, screws onto the head and has a drain cock in the bottom. Change of cartridge is quickly made without tools, and the saturated cartridge can be reactivated by heating an oven. Full details, including installation and operating instructions, are given in 4-page Catalog 3150.

Circle 274 on Reader Service Card

AIR MOTORS . . . pumps and boosters are described in 16-page Catalog 1957 published by Leiman Bros., Inc. Booklet gives details of construction, dimensions, capacities, new performance curves, and installations. Types covered include 2 and 4 wing, fan-cooled, water-cooled, radiator air-cooled, motor-driven, direct-coupled, belt-driven, integral pump and motor, and automatically controlled tank units.

Circle 275 on Reader Service Card

LIQUID FILTERS . . . manufactured by The Air-Maze Corporation are covered in their Engineering Bulletin LFC. Booklet gives complete data on these all-metal, liquid filters for designers and users of hydraulic equipment. Units are of special metal screen disc construction with precisely controlled openings to assure positive filtration for selected degree of separation. Sizes are from 1.7 to 720 gpm capacities. Specific data is given on gpm, pressure drop, inlet and outlet sizes, weight, overall dimensions and required clearance for cartridge removal.

Circle 276 on Reader Service Card

FLUID MOTORS . . . hydraulic pumps and valves for hundreds of varied applications are illustrated and discussed in 16-page brochure available from Webster Electric Company. Booklet details function and design of oil hydraulic pumps, tandem pump and motor-pump combinations and control valves. Applications cover agricultural implements, industrial trucks, power steering, tractor loaders, machine tools and construction equipment. Specifications, capacities and performance data are given.

Circle 277 on Reader Service Card

FLUID SEALS . . . and related problems are discussed in 12-page illustrated bulletin describing the products of Chicago Rawhide Manufacturing Company. Specific products covered include shaft and end face seals, molded parts, mechanical cups, packings and washers, non-metallic gears and pinions, leather

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Whatever your cylinder requirements, you're sure of dependable operational performance with efficient, close-tolerance BHEW cylinders that require minimum mounting space. Built to meet your specifications, their cost is reasonable; there is no charge for tooling; they are delivered on schedule.

BHEW CYLINDER FEATURES; • Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

For full information, send us specifications of your requirements.

Double-Acting 2-piece Piston Rod Cylinder. It is excellent for extending and retracting boom arm. Both hoses are connected on rod end. →

1. Hinged mount for alignment.
2. Honed steel cylinder.

Do you have cylinder problems? Our engineers will be happy to work with you without charge.

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protective boots, diaphragms and wipers. Size ranges and general specifications and performance data are given for each product.

Circle 278 on Reader Service Card

TUBULAR STEELS . . . Fluid power engineers involved in the problems of corrosion and high temperature service will benefit from the technical data contained in data sheets ASL 285 and 286, issued by the Tubular Products Division of the Babcock & Wilcox Company. Chemical analysis of Croloy is given, along with size range, specifications, mechanical properties, corrosion resistance and welding characteristics.

Circle 279 on Reader Service Card

BLOWOUT PREVENTERS . . . accumulators, controls, and general service and high pressure, plain end plunger pumps manufactured by Payne Manufacturing Company, Inc., are described in their 20-page illustrated catalog. Complete engineering data, installation, maintenance and operation are covered.

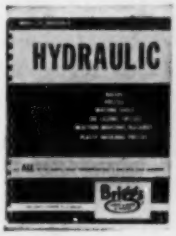
Circle 280 on Reader Service Card

Continued on next page

Circle 26 on Reader Service Card

BRIGGS OFFERS YOU, FREE, A 12 PAGE MANUAL ON HYDRAULIC FLUID CIRCUITS AND HYDRAULIC OIL FILTRATION

HERE is a big 8½" x 11", file size, 12 page, fully illustrated booklet. It's brimful of technical data and drawings that every designer and engineer will want to read or keep for ready reference. Write for your copy. No obligation.



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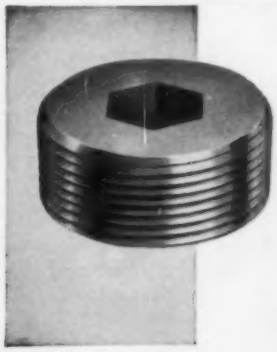

specify standard UNBRAKO Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOs seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1¼"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

Circle 151 on Reader Service Card

★Model 1AM ★Model 2AM ★Model 4AM ★Model 6AM ★Model 8AM

GAST ROTARY AIR MOTORS

are explosion-proof, variable in speed, low in cost!

Connected to any compressed air line, Gast Air Motors offer you:

1. Explosion-proof power. No danger!
2. Low initial cost per rated h.p.
3. Variable-speed with valve control.
4. Can't burn out from overloads.
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7. Very compact—light in weight.
8. Top-quality ball-bearing design.

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1 AM	2,000 5,000	0.11 0.21	0.13 0.30	1½
2 AM	1,000 2,000	0.22 0.40	0.35 0.57	5⅛
4 AM	1,000 2,000	0.48 0.78	0.73 1.10	7½
6 AM	500 2,000	0.40 1.30	0.65 2.00	18
8 AM	500 1,500	1.00 2.30	1.45 3.80	25

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
• AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

Circle 62 on Reader Service Card

An important announcement in the aircraft field

AIRCRAFT HYDRAULIC DESIGN

by GEORGE R. KELLER
Group Leader,
Flight Control Engineering Dept.
Autonetics, A Division of
North American Aviation

George Keller is responsible for development, design, and testing of hydraulic systems and power servo-mechanisms for the flight control systems of missiles and inhabited aircraft.

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APPLIED HYDRAULICS Magazine

- **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, AIRCRAFT HYDRAULIC DESIGN has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

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The advance of industrial hydraulics in servo components and systems makes this book of great value to designers of industrial equipment as well as aircraft engineers.

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The Industrial Publishing Corporation
812 Huron Road • Cleveland 15, Ohio

Please send me ——— copies of AIRCRAFT HYDRAULIC DESIGN

☐ Bill me (order no. ———) ☐ Money order attached

NAME .....

ADDRESS ..... CITY ..... STATE .....

Useful Literature continued

PIPE FITTING . . . self-sealing, and designed to eliminate pipe connection leaks, is described in a brochure issued by Tru-Seal Division of Flick-Reedy Corporation. The 8-page folder describes the Tru-Seal fitting which stops leaks in new and old pipe circuits without use of conventional sealing compounds or dopes. The self-sealing feature is made possible by a thin, nut-like fitting with a dry insert of Teflon applied during manufacture. Fitting is simply threaded on the pipe and a permanent seal is made with little force or effort. A 3-step diagram illustrates how the fitting is installed. Typical uses and applications are given for many industries.

Circle 281 on Reader Service Card

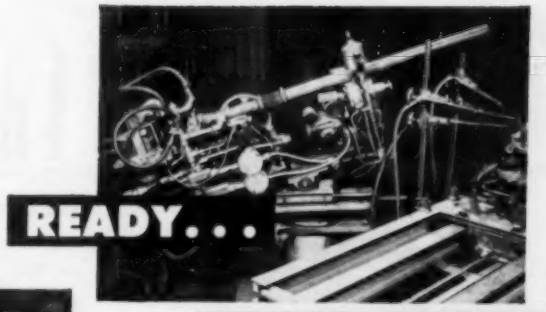
CHECK VALVES . . . MS-type, lightweight, aluminum alloy check valves for 3,000 psi service are produced by the Tactair Valve Division of Aircraft Products Co. Tactair Series 1800 includes four aluminum alloy check valves offering a 55 percent weight saving over conventional steel valves. Complete pressure and temperature specifications for the seven valves are listed in a 2-page bulletin. Tabular data is given on basic materials, rated flow capacity, dimensions and weights. Special attention is given the 1/2-inch valve as it is the first aluminum alloy valve to be approved as MS-28890-8. MS approval on the other six valves is pending. Four sizes, 1/2, 5/8, 3/4 and 1-inch OD, are made from aluminum alloy. Three sizes, 1/4, 5/16 and 3/8-inch are made from steel tubing.

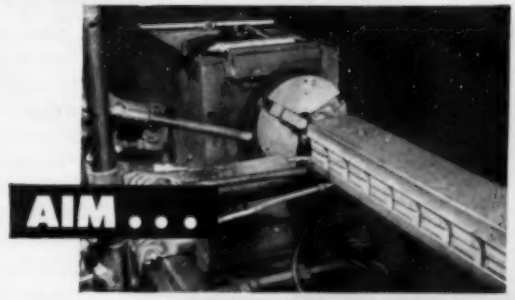
Circle 282 on Reader Service Card

HYDRAULIC HAND PUMPS . . . for 1500 and 3,000 psi service are described in Catalog 119 available from Bendix Aviation Corporation's Pacific Division. Units were developed to meet Specification MIL-P-5515, and consist of a single-piston, double-acting arrangement with an integral suction check valve mounted at right angles to the main bore. Design will withstand applied handle loads of 200 pounds. Plastic poppet seats directly in the aluminum alloy body without inserted steel seats and can be replaced in service without lapping or pre-seating. Pumps are available with or without handles.

Circle 283 on Reader Service Card

LINDE's Flame-Plating gun is operated entirely by remote control. At control panel (below) is operator, who observes process through safety-glass window. At right, Flame-Plating gun is seen as workpiece is secured in fixture (top), as gun is brought into range (center), and at the instant of a blast in the plating action (bottom).





Not all guns shoot BULLETS ...this one gives metal parts EXTRA WEAR RESISTANCE

A dramatic and useful coating process for metal parts has been developed by LINDE engineers to provide extra resistance to wear and abrasion. This method, called Flame-Plating, utilizes a special, rapid-fire gun to apply an extremely hard coating of tungsten carbide or aluminum oxide on precision parts subject to unusual wear or fretting corrosion.

The Flame-Plating gun consists of a barrel and a mechanism for loading precise amounts of powdered coating material and explosive gases into a firing chamber. The powder—tungsten carbide or aluminum oxide—remains suspended in the gases until a controlled spark ignites the mixture.

The resulting detonation creates heat and pressure waves of tremendous force. These waves rip through the gas-and-powder mixture at supersonic velocity. The particles are hurled against the work with terrific impact. They fuse together and build up until the desired thickness is obtained.

The temperature of the workpiece seldom exceeds 400 degrees F. Thus precision parts can be Flame-Plated without risk of changes in physical dimensions or metallurgical properties. Coatings can be Flame-Plated in thicknesses from .002 to .010 inch, and finished to 0.5 microinches rms. Practically all metals can be Flame-Plated.

The extra resistance of Flame-Plated parts to wear, abrasion, and fretting corrosion has been proved in actual service. Vital parts in aircraft and automotive power plants, hydraulic systems, and heating units, as well as textile and canning machinery, plug and ring gages, bearings, and seals have all had their useful life greatly extended—and economically, too—with Flame-Plating by LINDE. Find out how Flame-Plating can help you improve your own design. Write for a free copy of the booklet, "Flame-Plating," F8065. Address "Flame-Plating, Department AH-3."

LINDE AIR PRODUCTS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, New York

In Canada: Linde Air Products Company, Division of Union Carbide Canada Limited, Toronto

The term "Linde" is a trade-mark and FPL is a service-mark of Union Carbide and Carbon Corporation.

Flame-Plating by Linde

Post Scripts of Industry

News about people, manufacturers and sales organizations

Robert Q. Sharpe
Socony Mobil Oil Company, Inc.

Donald M. Van Waldick
Fort Wayne Division
The Weatherhead Company

Willis D. Horner
The Allen Manufacturing Company

Robert Q. Sharpe, staff engineer of the industrial division, lubricating department of **Socony Mobil Oil Company, Inc.,** New York, has been given the post of chief engineer of the department. Sharpe was the 1956 chairman on hydraulic fluids for the National Conference on Industrial Hydraulics.

The Fort Wayne Division of The Weatherhead Company has added **Donald M. Van Waldick** to serve as field engineer and sales representative in Northern Illinois, Michigan City, Indiana and Davenport, Iowa.

Ralph L. Goetzenberger, vice president of **Minneapolis-Honeywell Regulator Company,** Washington, D. C. resigned, but remains as educational consultant. He will continue to make his headquarters in Washington.

Raymond J. Condon was promoted to divisional vice president in the Washington government-projects office.

Charles F. Woods has been appointed western sales manager for the company's Valve Division. With headquarters in the Dallas office, he will be responsible for the southwest, Pacific and north coasts, and the mountain regions.

Willis D. Horner has been elected vice-president in charge of sales, and a director of **The Allen Manufacturing Company** of Hartford, Conn. Horner has been associated with Allen for twenty-two years.

Skinner Chuck Company, New Britain, Connecticut, announced plans for extensive new building additions to provide additional space for engineering, production and storage.

Bendix Aviation Corporation's Pacific Division named **James G. Weldon** hydraulic sales manager. Weldon succeeded **Robert G. Hoof,** who was appointed electromechanical manager.

J. D. Gould Company are now located in their new and larger factory and office building at 4707 Massachusetts Avenue, Indianapolis, Ind.

The Rucker Company's Seattle operation is in new headquarters at 1000—4th Avenue South. New facilities are larger and more centrally located. **Leonard E. Peters** has joined the Seattle staff as field engineer.

Paul H. Carlson was appointed advertising manager for **The Babcock & Wilcox Company's Tubular Products Division,** Beaver Falls, Pa.

Claude L. Huey is the new manager of the company's Atlanta district, succeeding **Paul R. Yopp** who has retired.

Robert K. Allen was made superintendent of product development at the Alliance, Ohio research center.

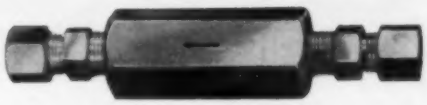
Continued on page 174

SECO hydraulic VALVES IN STOCK

Simplex Engineering has had many years of experience in designing hydraulic circuits, and in building all types of hydraulic power and control systems. We have always used the most suitable components obtainable for each application – regardless of who the manufacturer might be. This we still do. Hence we well realize that there are many good *valves* of every type. We have, however, designed numerous valves for our own use – where there was evident a real need for lower cost, or greater simplicity, or the ability to perform at higher pressures. These valves we manufacture in quantity, *and carry in stock*. They are for sale "off the shelf".

SAFETY RELIEF VALVES

For limiting operating pressures. Six models—500 to 10,000 PSI—each adjustable within limits. Chatterless. Relief set by adjusting screw. Hooded, and provided with lock and key.



HIGH PRESSURE CHECK VALVES

Simple ball check passes flow in one direction only. Designed for pressures up to 10,000 PSI.

HANDWHEEL SET RELIEF VALVES

Ideal where quick and frequent adjustment of pressure is required. Three models — 1,000 to 6,000 PSI.

UNLOADING VALVES (Not Illustrated)

Designed to insure high pressure pump unloading at all times except at the interval when pressure is needed.

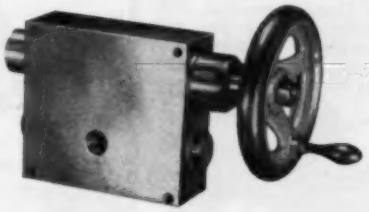
PILOT OPERATED CHECK VALVES

Basically a check valve, but allows free reverse flow when pilot pressure is applied. Seven models cover flow range of 6 to 100 GPM. Max. operating pressure 6,000 PSI.

PILOT OPERATED BLOCKING VALVES

Similar to valve described above except that pilot section is externally drained. For use where back pressure occurs in the inlet line. Models cover same range as Pilot Operated Check Valves.

HIGH PRESSURE 4-WAY VALVES



For manual control of many simple hydraulic circuits involving double-acting cylinders. Permits fine graduation of pressure and volume. Body is forged steel. Pressures up to 10,000 PSI.

If you use hydraulic valves you should have the SECO Catalog. Use the reader's service card.

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

Post Scripts of Industry
continued

Jas. P. Marsh Corporation appointed **F. O. Pauls** as advertising manager. Pauls has been with Marsh for over fifteen years.

F. O. Pauls
Jas. P. Marsh Corporation

A new sales office has been opened in Baltimore by the **Clark Controller Company,** at 2319 Maryland Avenue, with **Edward M. Hanson** as manager.

Automatic Switch Company, Orange, New Jersey, appointed two distributors: **Good Supply & Equipment Company,** 905 Miami Street, Akron, Ohio; and **McKeever Electric Supply Company,** 212 North Grant Ave., Columbus, Ohio.

The Bristol Company, Waterbury, Conn., has appointed **John E. Kearns** manager of a new district sales office at San Francisco, Calif.

William D. Wallace will represent **Republic Rubber Division, Lee Rubber & Tire Corporation,** in a newly created outstate Michigan territory. Wallace will headquarter in Mason, Michigan.

Harry M. Gill was made advertising manager of **Young Radiator Company.** Gill was formerly with Airtex Products, Inc.

Harry M. Gill
Young Radiator Company

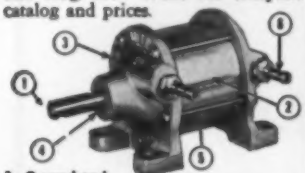
Construction is under way on **United States Rubber Company's** new 45,000 sq. ft. building to provide additional manufacturing, warehouse, and office space for its power transmission belt plant in Philadelphia's Tacony area. Completion is scheduled for June of this year.

Continued on page 176

AIR-MITE AIR CYLINDERS

Low Cost . . Compact . . Powerful . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE Devices, Inc.

4401 W. KINZIE • CHICAGO, ILLINOIS

BECKETT Hi-CYCLIC

SOLENOID VALVE-PILOTED AIR VALVES

✲ Full Pressure Piloted

¼ SIZE
MODEL BVP1—Single Solenoid less exhaust controls
F.O.B. Wilmington, Ohio.

✲ ⅛" to 1" sizes, single and double solenoid. High speed • Accurate control • Compact • Low current demand • Write for detailed information.

Look to Beckett for advanced design! A complete line—150 models—of air and hydraulic directional control valves ... *precision-built, economically priced!* Send for catalog.

BECKETT-HARCUM CO., INC.

1086 WAYNE ROAD, WILMINGTON, OHIO

Circle 5 on Reader Service Card

Circle 21 on Reader Service Card

Circle 32 on Reader Service Card

HYDRAULIC ENGINEERING FOR INDUSTRY

CARDWELL

TRADEMARK SINCE 1829

DESIGN SERVICES
FABRICATION
POWER UNITS
HYDRAULIC PANELS
ELECTRICAL CONTROL PANELS
ACCUMULATORS
STOCKING DISTRIBUTORS
HYDRAULIC COMPONENTS

Complete Engineering and Design Services Are Available. Qualified Sales and Service Engineers in Most Areas.

The CARDWELL MACHINE COMPANY
Quality — A CARDWELL TRADITION SINCE 1829
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593

NEW 'Telltale Strainer':

PATENTS APPLIED FOR

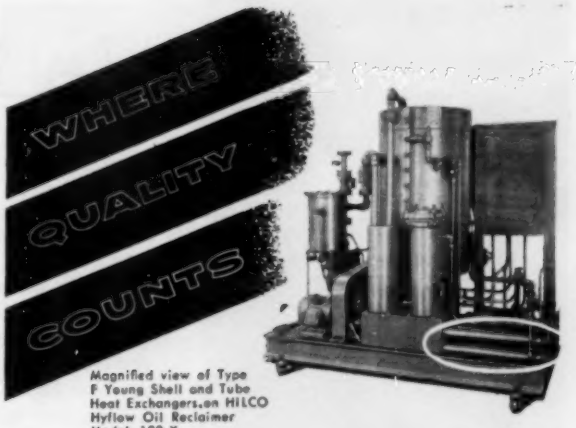
Stop pump damage due to clogged strainers

When the Telltale Strainer gets clogged, it shifts over, by-passing oil around itself. And it tells you this by a red signal which shows in window. Automated set-ups can use optional limit switch for signal light. Moving strainer out of tank permits easier maintenance and lowered intake opening in tank, increasing usable oil supply by a fifth. Manifold may be had to mount dual strainers, permitting strainer removal with no down-time, and doubling strainer capacity to 40 gpm.
Write for more information.

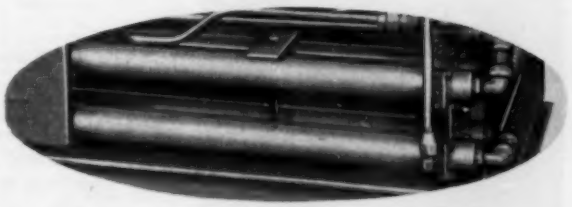
Attention Dealers—write us for more information.

The ROSAEN COMPANY
1776 EAST NINE MILE ROAD • HAZEL PARK, MICHIGAN

Circle 182 on Reader Service Card



Magnified view of Type F Young Shell and Tube Heat Exchangers on HILCO Hyflow Oil Reclaimer Model 100-X.



Young HEAT EXCHANGERS

Perform Double Duty on Oil Reclaimer

Shown above is the HILCO oil reclaimer made by the Hilliard Corp., Elmira, N. Y. Used for the purification and complete dehydration of new refrigeration compressor lubricating oil it delivers 100 gph of oil to the compressor charging board.

Function of the Young Heat Exchangers in the process is to reduce electrical energy — required to heat the oil to vaporizing temperature — and to reduce the temperature of outgoing, clean vaporized oil.

Young Heat Exchangers are used in all kinds of applications — commonplace and unusual. It is well to remember that *where quality counts* Young has dependability plus low initial and operating costs as well as larger cooling surface per unit volume of space.

Write Dept. 447-C for FREE Catalog

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Montreal, Illinois

Circle 180 on Reader Service Card

ACCURATE TEMPERATURE CONTROL of Hydraulic Liquids PREVENTS LOSSES

● This NIAGARA AERO HEAT EXCHANGER cools the liquid for a large hydraulic press, preventing heat damage to the pump stuffing boxes. Using outdoor air as the evaporative cooling medium, it removes the heat at the rate of input (1,875,000 BTU/hr.) with no cooling water consumption except a negligible amount evaporated.

Similar Niagara machines cool water, oils, solutions, lubricants and coolants for many mechanical, electrical and chemical processes. In a closed system, your coolant is never contaminated. The system is simple and easy to keep up; the equipment has a long, useful life.

Write for Bulletin 120 for a complete description

NIAGARA BLOWER COMPANY

Dept. AH-3, 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in Principal Cities of United States and Canada

Post Scripts of Industry — continued

Tuthill Pump Company, Chicago, Ill., has awarded their northern Ohio territory to **The Pacquin Company,** 13405 St. Clair Avenue, Cleveland 10, Ohio. Pacquin will act as exclusive sales representatives for Tuthill in the northern half of Ohio, exclusive of Toledo, and in counties west and directly south of Toledo.

E. F. Koenig has been appointed technical representative of the Technical Services Division of **The Texas Company's** Research and Technical Department, with headquarters in Beacon, N. Y.

Racine Hydraulics & Machinery, Inc., Racine, Wis., has appointed these new dealers: In the Province of British Columbia, **Tridel Equipment Limited,** 1575 West Georgia Street, Vancouver 5, with **John H. Rees** as manager. In Florida, **J. T. Sudduth and Company, Inc.,** Jacksonville, with **Lou H. Schliecker** as the field representative.

S. G. Morris, Racine representative in Cleveland, Youngstown and Pittsburgh, has opened a fourth office at 2639 Upton Avenue, Toledo, Ohio, with **A. E. LaChance** as manager.

Harold Y. Sampson was elected president of **Wilkerson Corporation,** Englewood, Colo. Sampson was assistant to former company president Dewey L. Wilkerson.

Harold Y. Sampson
Wilkerson Corporation

Randolph H. Jackson was made sales director of **Boston Woven Hose & Rubber Company,** Boston, Mass.

Hummel Technical Products, 90 West Street, New York 6, N.Y., was appointed as eastern New York State representatives for **Snap-Tite, Inc.,** Union City, Pa. Joseph D. Wiley, Jr. is president of Hummel.

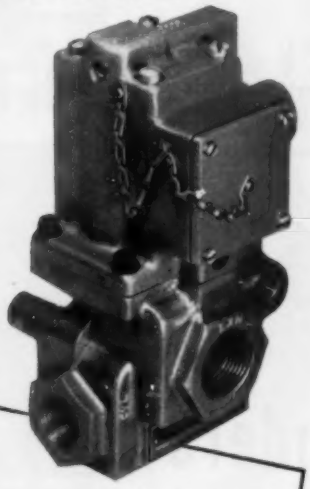
Continued on page 178

Sprague Engineering Corporation now occupies their new office and factory building located at 19300 South Vermont Avenue, Gardena, California. Situated on a five-acre tract, the 76,000 sq. ft. building includes office space and features innovations for time savings in office and factory operations. This new facility centralizes Sprague's operations and provides needed room for expansion.

Circle 18 on Reader Service Card

J.I.C.
IN-LINE 3-WAY SOLENOID VALVES

$\frac{1}{4}$ • $\frac{3}{8}$ • $\frac{1}{2}$ • $\frac{3}{4}$ • 1 • 1$\frac{1}{4}$



- NORMALLY CLOSED OR OPEN
- CONTINUOUS DUTY SOLENOIDS
- MOST A C & D C VOLTAGES

Write for Bulletin—Prices

COMPLETE LINE OF

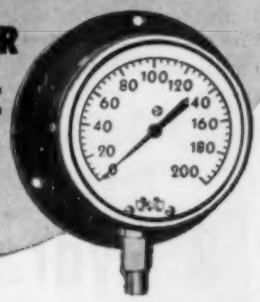
Air Control Valves by

AUTOMATIC VALVE CO.

37415 GRAND RIVER AVE • FARMINGTON, MICH.

Circle 107 on Reader Service Card

MARSHALLTOWN
THE RIGHT GAUGE FOR YOUR SPECIFIC NEEDS



- PRESSURE
- VACUUM
- COMPOUND
- ALTITUDE
- COMBINATION
- DIAPHRAGM
- HYDRAULIC
- AND SPECIAL PURPOSE GAUGES
- DIAL THERMOMETERS

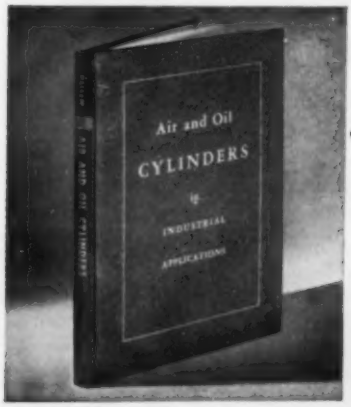
(Vapor Tension or Bi-Metal)

• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

WRITE TODAY FOR COMPLETE INFORMATION

MARSHALLTOWN MANUFACTURING CO.

800 EAST NEVADA ST.
Marshalltown 4, Iowa



AIR & OIL CYLINDERS

Elmer Heiser has written this valuable cylinder handbook which tells about types, cushions, how to order, proper porting, correct sizing, packings, and efficient installation methods.

It's full of application ideas.

PRICE $5.00

The Industrial Publishing Corporation

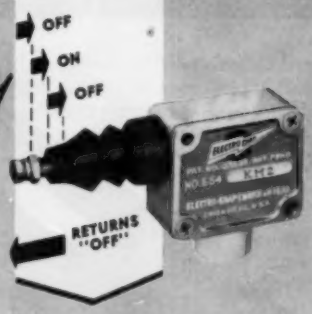
812 Huron Road • Cleveland 15, Ohio

AUTOMATING?
Keep It Simple

with the ELECTRO-SNAP

One-Way Impulse

PRECISION LIMIT SWITCH



Type ES4-KM2 shown

Before finalizing design on your automatic tools or systems, get full details on the ELECTRO-SNAP ES4 family of switches. Many variations available . . . all trouble-savers!

- Fewer switches needed.
- Simpler, cheaper than timers.
- More reliable than fancy circuitry capable of same job.

WRITE FOR DATA SHEET ESF-1

ELECTRO-SNAP SWITCH & MFG. CO.
4224 West Lake Street
Chicago 24, Illinois

ELECTRO SNAP

Circle 55 on Reader Service Card

Post Scripts of Industry continued

New director of quality control for **Vickers Incorporated** is **R. J. Sullivan.** His responsibilities will include coordination of Vickers divisions in Detroit, Omaha, Nebraska, Joplin, Missouri, and Jackson, Mississippi.

Philip E. Golde and **A. G. Handschumacher** were elected senior vice presidents of **Lear, Inc.,** Santa Monica, Calif. Golde is secretary and general counsel and Handschumacher is director of sales and overseas operations.

Stewart-Hunt, Inc. has been formed as successors to James Stewart Company. **James H. Stewart,** president, has been in the fluid power industry for the past 12 years. **Lawrence B. Hunt** is vice president.

James H. Stewart
Stewart-Hunt, Inc.

Lawrence B. Hunt
Stewart-Hunt, Inc.

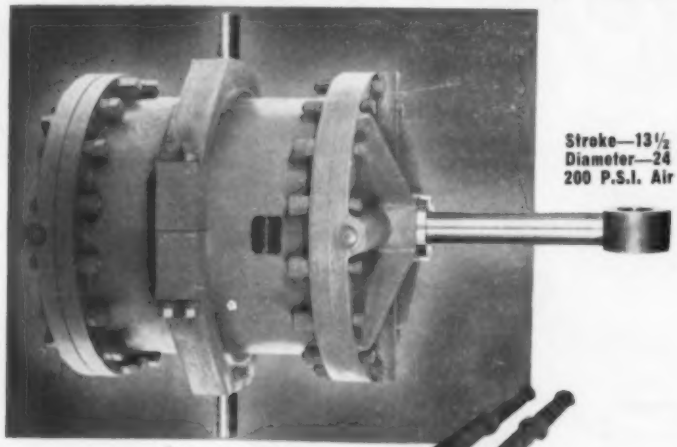
Kempton Dunn, president of **American Brake Shoe Company,** was elected chief executive of the company, succeeding **William B. Given, Jr.,** who will continue as board chairman.

A new 70,000 sq. ft. plant has been opened in Scarborough, Ontario (part of Metropolitan Toronto) by **Canadian Controllers Limited,** a subsidiary of **Clark Controller Company,** Cleveland. The new plant represents a 50 percent increase in floor area over previously occupied facilities, and is planned to permit expansion to three or four times present size.

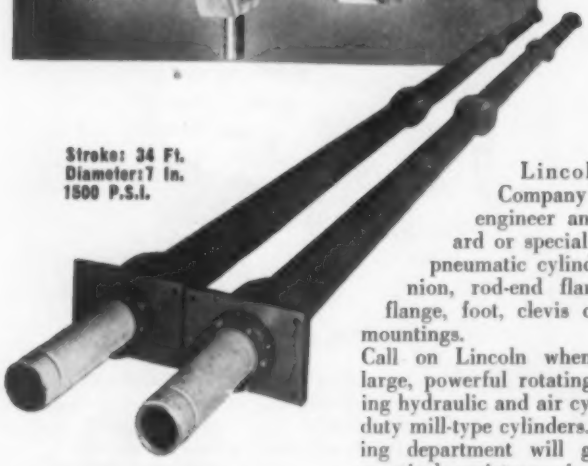
Continued on page 180

Air & Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 32" DIAMETER • STROKES OF 50 FT. AND LONGER.



Stroke—13½ Inches
Diameter—24 Inches
200 P.S.I. Air Pressure



Stroke: 34 Ft.
Diameter: 7 In.
1500 P.S.I.

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunnion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

LINCOLN MACHINE CO. INC.
P. O. BOX 272 • SALEM, OHIO

Circle 108 on Reader Service Card

IF IT FLOWS THROUGH HOSE SEE MAYSON

Yes we have Hose Swivels for nearly any fluid or gas. Non-Flammable Oils, Steam, Detergents and even helium gas at up to 3500 psi.

Need a swivel for 3000 psi oil? We have them on presses.

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

DESIGNER APPROVED
FOR OVER A DECADE

NEW LOGAN RFL UNIT No. 400

Companion unit to the popular Logan No. 400.

- √ Compact, Complete
- √ Air Line Filter
- √ Pressure Regulator
- √ Lubricator

For maximum efficiency insist on Logan RFL Unit . . . the lubricating unit machine tool designers have been using for over a decade.

FREE
Handy Logan CALCULATOR
Mailed promptly on request.

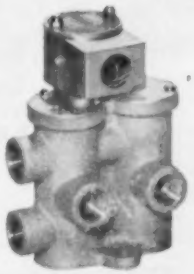
WRITE FOR CATALOG 100—SECTION 4

Logansport Machine Co., Inc.
832 Center Avenue
Logansport, Indiana

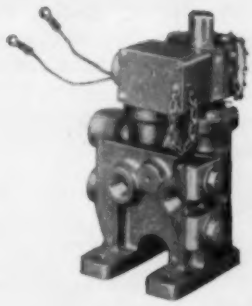
Crescent® Solenoid Valves give

LONGER SERVICE for LESS MONEY

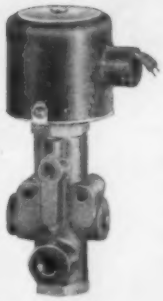
We invite your on-the-job comparison



Standard 4-Way



J.I.C. Type 4-Way



Standard 3-Way

® 4-Way and 3-Way Solenoid operated, pilot controlled valves for Air, Water and light oil to 150 P.S.I., products of Crescent Valve Co.

NO COIL BURNOUT

because a generous power margin, short solenoid travel and pilot operation combine to prevent overheating and overloading. Note that these valves are accepted and used in automotive plants where assembly line production does not permit coil or valve failure.

LONG SERVICE LIFE

Main valve design is aimed at extremely long trouble free service. Resilient seats are tight sealing and are not affected or damaged by dirt or grit because they are of a self scavenging design. Witness their superior performance in such severe service as operating hopper doors on cement batching equipment and in other dusty environment.

INTERCHANGEABILITY

Solenoids and pilot sections are interchangeable from one valve size to another, minimizing spare parts requirements. Adaptation to any practical voltage is achieved by a simple coil change.

Speed of response, speed of installation and dependable leakproof operation year in and year out are responsible for the increasing switch to Crescent valves on production machinery where time is money.

For complete data write for Catalog 6-C.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

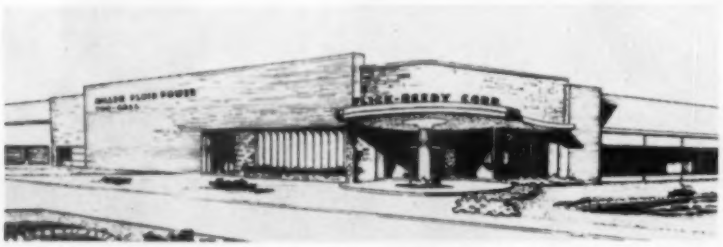
Circle 102 on Reader Service Card

Circle 20 on Reader Service Card

Post Scripts of Industry
continued

A. W. Cash Company, Decatur, Ill., and its subsidiary **Cash Standard Stacon Corporation,** appointed **K. C. Brown Company,** Kansas City, Mo., as their representative in Kansas and western Missouri.

Alco Products, Inc., Schenectady, N. Y., announced **T. I. Equipment, Inc.** of Cleveland, as its exclusive agent in northeastern Ohio. T. I. Equipment maintains offices at 15017 Detroit Avenue, Cleveland, Ohio.



This is an artist's conception of **Flick-Reedy Corporation's** new 2-million-dollar plant being constructed in Bensenville, Ill., near Chicago. Flick-Reedy, now in Melrose Park, Ill., expects to move its two divisions, Miller Fluid Power Division and Tru-Seal Division, into the new 220,000 sq. ft. facility this fall. The new plant is expected to increase production by 70 percent.

Joseph H. Kasper, Jr., joined the sales engineering staff of **Pneu-Hydraulics, Inc.,** Cleveland, Ohio. Kasper was previously in the automation design section of General Motors Corporation.

Crane Packing Company has completed a 3-year expansion and construction program to improve its manufacturing and service facilities throughout the United States and Canada. Construction included erection of four new plants at Houston, Texas; the Chicago area; Los Angeles; Hackensack, New Jersey; and expansion of offices and factory at Hamilton, Ontario, Canada.

Technology Instrument Corporation, Acton, Mass., has completed its half-million dollar addition to its Acton plant. The new facilities will permit programming production to meet present demands and prepare for anticipated increases.

What a sight!

CENTURY'S

All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS, INC.
7703 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone: Diamond 1-3797

Now! BAR STOCK BRASS HOSE FITTINGS That Give You Maximum Flow of Air and Water

Service Mfg. & Supply Co. J.I.C. union type fittings are available with 37° flare adapters—elbows are 45°, 90°, in standard and long lengths. All fittings are wide aperture and machined from top quality bar stock. This gives you non-porous and maximum flow fittings.

J. I. C. Union type

Solid type

Special Design—Designing and manufacturing special fittings to your prints is our specialty. In addition, our complete stock of non-porous wide aperture standard fittings will serve your normal needs.

Short-Runs—Designing and manufacturing short-run orders is also a specialty of Service Mfg. & Supply Co. Fittings range from any length elbows to special "Y" fittings. Write today for catalog.

"Y" fittings—Standard stock or designed from your prints.

Jobber and agent inquiries invited.

Service Mfg. & Supply Co.
315 East State Fair Detroit, 3, Mich. TWinbrook 3-6565

Circle 35 on Reader Service Card

Circle 143 on Reader Service Card

Automatic Switch Company, Orange, N.J., announced appointment of **Moore Brothers Electric Company,** 2602 Leith Street, Filnt, Mich., as stocking distributors.

Crane Packing Company, Morton Grove, Ill., announced these four promotions: **Carl E. Schmitz** to executive vice president, **Vance E. Vorhees** to vice president in charge of sales, **B. H. Stenberg** to vice president in charge of manufacturing, **E. H. Stubenrauch** to assistant general sales manager.

Carl E. Schmitz
Crane Packing Company

Vance E. Vorhees
Crane Packing Company

Harold Ames, Jr. was named president of **Electro-Snap Switch & Manufacturing Company,** Chicago, Ill.

Electric Hose & Rubber Co., Wilmington, Delaware, elected **V. W. Wells,** vice president and sales manager.

Continued on next page

NOW . . .

high efficiency

Filters, Regulators, and Lubricators
for Air Supply to Pneumatic Equipment

with the NEW
WATTS **high efficiency** LINE

consisting of:

WATTS high efficiency FILTER

New TORNADO ACTION

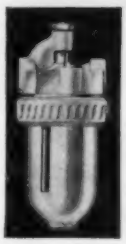
Contoured inlet eliminates drastic air pressure drop and forces the air into a downward spiral. This "Tornado Action" sets up centrifugal force which spirals dirt and moisture particles downward into the "quiet zone."

WATTS high efficiency REGULATOR

New ASPIRATOR ACTION

Watts Aspirator control acts directly on input valve, giving instant compensation for fluctuating pressure demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

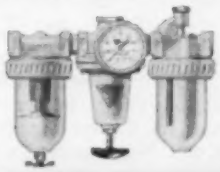
WATTS high efficiency LUBRICATOR



New BY-PASS PICKUP

Watts new By-Pass Pickup makes possible an exclusive high velocity venturi section which vaporizes virtually 100% of the metered oil. By-Pass permits maintenance of constant pressure in the venturi section with minimum pressure loss.

Complete range of Sizes: 1/4", 3/8", 1/2"



BOWLS CAN BE REMOVED IN 30 SECONDS

Write for catalog and specification sheets on WATTS high efficiency line.

WATTS REGULATOR COMPANY
SINCE 1875

8 EMBANKMENT ROAD LAWRENCE, MASSACHUSETTS

Post Scripts of Industry continued

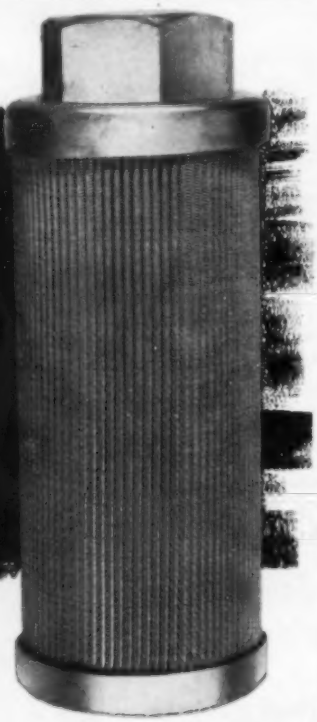
Glidden Engineering and Equipment Company, Houston, Texas representative of Automatic Switch, has opened a new office at 314 Cole Street, Corpus Christi, Texas.

Wayne Belden has retired from the presidency of **Ajax Flexible Coupling Co., Inc.,** and will continue on the board of directors as marketing and public relations counsel.

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

Robert E. Ward was named director of manufacturing of **The New York Air Brake Company.** Ward was formerly with Bendix Aviation Corporation.

Robert E. Ward
The New York Air Brake Company

Continuing its expansion, **McGill Manufacturing Company, Inc.,** Valparaiso, Ind., has earmarked almost one million dollars for new machines, tools and related equipment for its bearings division. An additional six hundred thousand will be used to construct 45,000 square feet of added manufacturing space.

John Henrikson has been appointed vice president in charge of sales of **Graton and Knight Company,** Worcester, Mass. Henrikson has served the company since 1917.

John Henrikson
Graton and Knight Company

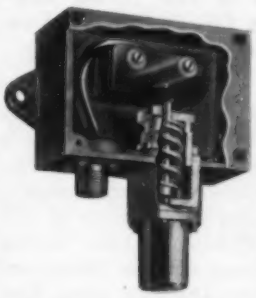
J. Robert Simpson, III, has been appointed sales manager for **Conoflow Corporation.** Simpson has been with Conoflow for the past ten years.

Continued on page 184

Circle 8 on Reader Service Card

NEW! Hydraulic and Pneumatic BONDEE PRESSURE SWITCH

With the PATENTED PRESSURE ELEMENT



Light Weight—Heavy Duty

1-OPERATES FROM 0 to 1200 PSI with over pressure as high as 3000 psi —will not distort pressure element.

2-ADJUSTABLE OVER ENTIRE RANGE from 0 to 1200 psi. Repeats accurately every time.

3-ADJUSTMENTS MADE EASILY without interfering with the pressure element.

TOTALLY ENCLOSED and TAMPERPROOF

Weather resistant cast aluminum alloy or stainless steel available. Arranged for wall or bracket mounting in any position. Uses any MICRO SWITCH, 15 amps, 120 to 460 volts, AC., with single pole double throw silver contacts. Also available for D.C. Applications.

Write for descriptive literature

Alloy Bellows Engineering Co.

18125 Roseland Rd., Cleveland 12, Ohio

Champ® HYDRAULIC HOSE ASSEMBLIES

For longer, Trouble-Free Power Delivery

- **PREVENTS BLOW-OFFS**—Sleeve *locks* to collar of stem!
- **MAXIMUM HOLDING POWER**—Stem *and* sleeve serrated for positive grip and seal!
- **HIGH VOLUME FLOW**—Design provides greater flow efficiency!
- **LONGER LIFE**—A flexible and integral unit of unfailing reliability!

WRITE FOR CATALOG 8001 for details on Champ Hydraulic Hose Assemblies and Engineering Service to meet specific performance for ALL HYDRAULIC POWER DRIVEN EQUIPMENT.

Request to have a Champ Engineer discuss your hydraulic coupling application.

® Reg. T. M.

Champ® DIVISION OF HOSE ACCESSORIES COMPANY

LEHIGH AVE. AND 17th STREET • PHILADELPHIA 32, PA.

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Circle 82 on Reader Service Card

THE ORIGINAL MONOPAK—CARTRIDGE

A complete packing unit for hydraulic or pneumatic rods or cylinders.

- **Easily installed or replaced.**
- **Needs no adjusting.**
- **Reduces initial machining expense.**
- **Longer service life.**
- **Includes "Seal-Guard" rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Cuts machine down-time.**

**Detailed literature on request.*

HYDRAULIC ACCESSORIES CO.

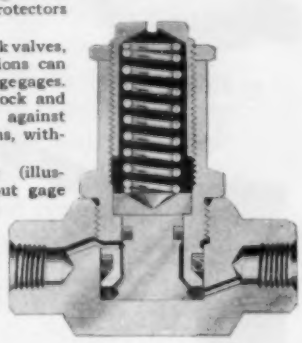
24301 Hoover Rd. Van Dyke, Mich.

SAFEGUARD YOUR GAGES WITH REPUBLIC PROTECTORS

PROTECT your expensive gages from damage with Republic Gage Protectors and Pressure Snubbers.

Fluid hammer, chattering check valves, and severe pressure fluctuations can cause extreme shock, and damage gages. Pressure Snubbers absorb shock and permanently protect gages against damage from wild fluctuations, without affecting accuracy.

Adjustable Gage Protector (illustrated) automatically cuts out gage when system pressure rises above gage range, and reopens when pressure drops. Two types—ranges 15 to 5000 psi; 3 to 50 psi. Working pressures to 10,000 psi.



Ask for catalog 654A.

Distributors in principal cities coast to coast.

RM REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

200

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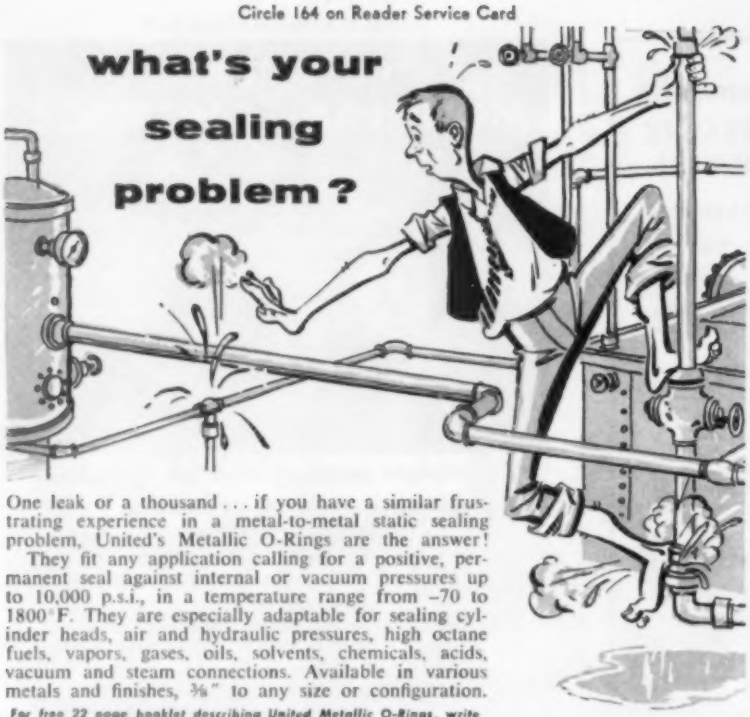
Circle 164 on Reader Service Card



One leak or a thousand . . . if you have a similar frustrating experience in a metal-to-metal static sealing problem, United's Metallic O-Rings are the answer!

They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from –70 to 1800°F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and finishes, ⅜" to any size or configuration.

For free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department G-2.

UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1035
Division of United Aircraft Products, Inc.

Post Scripts of Industry continued

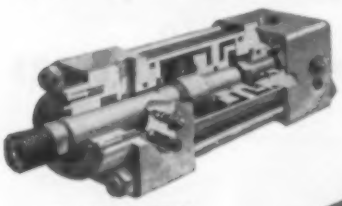
Appointment of **Robert G. Chown** as sales engineer was announced by **The Teglen Engineering Co., Inc.,** South Pasadena, California.

A. W. Cash Company, Decatur, Illinois, and its affiliate, **Cash Standard Stacon Corp.,** have opened a direct company sales office in Chicago at 332 South Michigan Avenue, serving the Chicago, northern Illinois and northern Indiana area. **Ken Weeks** and **Bob Lefley** will be in charge. **William Schupner** was made chief engineer for fluid power products.

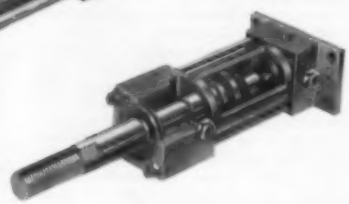
Farrel-Birmingham Company, Inc., Ansonia, Conn., appointed **Adolphe J. De Matteo** general manager of their **Watson-Stillman Press Division,** Roselle, N. J.

PETCH CYLINDERS

meet J.I.C. & NC-I STANDARDS *providing* "MOTOVATION for AUTOMATION"



☐ TIE-ROD Design
Low Pressure Hydraulic 500 psi—1½"-10" bores; High Pressure Hydraulic 1500 psi 1½"-6" bores; Air 200 psi—1½"-10" bores



☐ AUTOMOTIVE heavy duty AIR
200 psi—1½"-6" bores

☐ BOOSTERS
Drive Cylinders 4", 5", 6", 8" bores Ratios 5:1 to 28.5:1

☐ TANKS
4"-10" bore sizes

Petch Hydraulic Devices include:

☐ HUPP Threadless Sub-Plates—Inserts & Swivel Fittings
☐ Limit Switch Actuator
☐ Oil Tank Sight Gauge

Send for catalog regarding the product or products for which you have use—each one includes complete specifications and engineering data. The complete PETCH portfolio consists of 96 pages of hydraulic and pneumatic information.

PETCH Pmc
465 York, Detroit 2 **MANUFACTURING COMPANY**

TRU-FLATE®

REUSABLE

BARB TYPE and REUSABLE HOSE FITTINGS

These **standard** and **heavy duty** hose fittings are designed to handle **air, gases** and low pressure water and oil. Extra large internal passage cuts pressure drop to a minimum. Most sizes available in **Steel** or **Brass.**

- Barb type fittings designed for **extra** gripping power. Produced in sizes from ⅛" N.P.T. to 1" N.P.T.
- All Tru-Flate **Reusable Fittings** grip on the **inside** as well as the **outside** for maximum holding power. Easily installed or removed.
- All "standard" fittings finished in Bright Brass; "heavy duty" fittings in steel with Rust Resistant "Gun Metal" Finish.
- Reusable Fittings available for welding hose with oxygen and acetylene male and female threads. Write NOW for our free catalog.

TRU-FLATE® INC.
888-92nd AVENUE • OAKLAND 3, CALIFORNIA

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Circle 160 on Reader Service Card

Horace Singleton has been made assistant vice president of **Robertshaw-Fulton Controls Company's Aeronautical Division. Chauncey N. Mynderse,** vice president and director since formation of the company, has retired.

True-Trace, El Monte, California, announced the opening of new branches: Midwest office, 1405—16th Street, Racine Wisconsin, Dan E. Harrison in charge; New York Office, 35 Urban Ave., New Cassel, Long Island, managed by Len Dubuke.

William J. Johnson is the new president and general manager of **Goshen Rubber Co., Inc.,** Goshen, Indiana. **Richard G. Bigler,** secretary, has been made assistant to the president, and **Wayne Burger,** treasurer. In addition to the above, members of the board of directors include **J. S. Royal, H. A. Anglemyer,** and **Joseph L. Lantz.**

A new district office for aircraft products sales and service has been opened by **Vickers Incorporated** in Seattle, Wash., with **John Shorkey** as application engineer.

As part of the expansion of their industrial electro-hydraulic servo group, **R. J. Render** was appointed as an application engineer working out of Vickers administrative and engineering center in suburban Detroit.

Purchase by the **Parker Appliance Company** of the **Franklin C. Wolfe Co., Inc.,** Culver City, Calif., and **Mathewson Corporation,** Los Angeles, has been announced. According to C. C. Sigmier, board chairman of Parker, the purchase will broaden the assistance Parker can give its customers. **Col. F. C. Wolfe** (ret.) who has been president and treasurer of F. C. Wolfe, will be president of the new division. All other officers and personnel of the two purchased concerns will be retained.

Continued on next page

as used by Struthers Wells

Struthers Wells Corporation, Titusville, Pennsylvania, manufacturers of quality bending machines, specify dependable H-P-M hydraulics for the smooth, positive action so important for metal bending operations. Here are the reasons: convenient off-the-floor design, easy access to all elements of the unit, compact solenoid operated valve panel system, easy-to-reach electric pushbutton controls and most important—dependable, job proved H-P-M components that provide solid satisfaction through years of service. You can rely on H-P-M—and recommend them for your OEM equipment. Send for complete catalog information, today.

HPM

HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

A DIVISION OF KOEHRING COMPANY

1877—1957

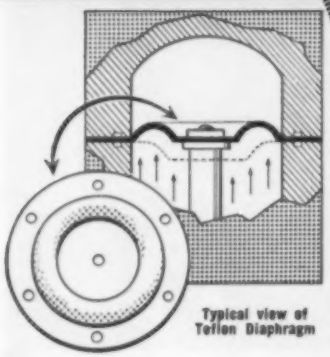
Circle 83 on Reader Service Card

for NEW PERSPECTIVES... let SPARTA help you put ideas to work with

CUSTOM MOLDED **TEFLON***

*DuPont's Tetrafluoroethylene Resin

IN THIN SECTIONS AND SHAPES!



Typical view of Teflon Diaphragm

Look to Sparta, pioneers in the development of custom molded Teflon parts (Pat. No. 2,781,552). Our highly trained Fluorocarbon engineering staff...modern manufacturing methods, are available to help you solve any design problems you may be experiencing with ordinary flexible materials.

The unique combination of properties of Teflon offers economical and product improvement opportunities never before possible.

When you think of **TEFLON** *think of SPARTA!*

We carry a COMPLETE STOCK of all standard Teflon products.

WRITE for complete data, prices, properties and applications without cost or obligation.

Dept. AH

The first cost can be the least . . . if it is the last cost.

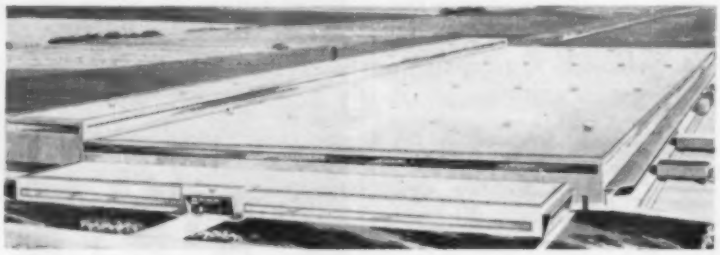
SPARTA MANUFACTURING CO.
Division of United States Ceramic Tile Co.
DOVER, OHIO PHONE 4-2380

WESTERN DISTRICT OFFICE
Phone: ANGELUS 3-6359 Los Angeles, California

Post Scripts of Industry continued

Two district managers have been appointed by **Worthington Corporation,** Harrison, N.J.: **E. Weston Hammond,** Los Angeles district office, and **J. R. Matullo,** Newark district office.

Pneumatic Industrial Equipment Company Limited, 2432 Kingston Road, Toronto 13, Ontario, Canada, is a new distributor for **Parker Appliance Company,** Cleveland, Ohio.



Standard Pressed Steel Company's new 5 million-dollar Santa Ana, California facility will be a highly functional, multi-product plant. Scheduled for completion early in 1958, the one-story unit will cover 280,000 square feet on a 47 acre site. Plant is designed for easy expansion to three times its original size.

NOW standardized...

PRECISION DRILLED MANIFOLDS and Sub-Plates

MODEL BHP-3002

Slash installation costs—Eliminate long cylinder lines—Give better cylinder action

Single feed manifold —shown with 4-way, flow and decelerating valves.

STANDARDIZED MANIFOLDS: Leak Proof, Solid Steel, Common tank, pressure and drain, All ports clearly marked, Mount near point of operation. These features give you lower cost installation and better performance.

SUB-PLATES: Side entering—All sizes to accommodate any standard hydraulic Valve.

SPECIAL DESIGNS: Our skilled craftsmen will design and manufacture Precision Drilled, Solid Steel, Leak Proof Manifolds to your specifications—Just send us a drawing of your circuit. We will give you a cost estimate. Write for catalog of standardized models.

BIRMINGHAM Hydraulic Products Co.

14540 Schaefer Road
Detroit, Michigan
Phone BR. 3-8047

 Circle 150 on Reader Service Card

Circle 25 on Reader Service Card

Circle 39 on Reader Service Card

the only truly

LEAKPROOF CHECK VALVE

Circle Seal valves are truly—the only 100% **reliable** leak-proof check valves. The Circle Seal "O" Ring sealing principle guarantees it! Years of use in many industrial applications proves it!

Zero leakage, 0-3000 psi
Unrestricted Flow
Low Cracking Pressure

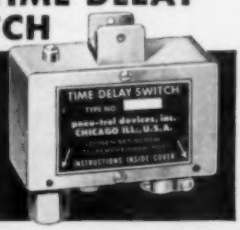
Get complete engineering data now.

Circle Seal Representatives throughout the United States

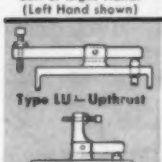
Circle Seal Products Co.
Incorporated
2181 EAST FOOTHILL BOULEVARD
PASADENA, CALIFORNIA

Pneu-Trol TIME DELAY CONTROL SWITCH

...Gives Cylinder Applications Greater Efficiency Accuracy ...Wider Use!

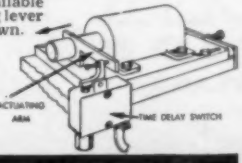


For any type actuation Left or Right Hand. (Left Hand shown)



- **Holds Cylinder dwell accurately to fraction of second.**
- **Automatically re-sets.**
- **Simple, Compact, Rugged.**

You can hold any motion or operation controlled or actuated by air or hydraulic cylinders at a positive stop on either end of the stroke for ¼ to 60 seconds in 20 to 1 ratios with Pneu-Trol Time Delay Control Switches. Simple in design with positive hydraulic timing action . . . compact and easily mounted on the machine or fixture, Pneu-Trol Switches are providing millions of trouble-free actuations in solenoid-operated cylinder applications of every type. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of the dwell. Available with 5 actuating lever linkages as shown.



Switch mounted to provide dwell at end of power stroke of single action, spring return cylinder.

Pneu-Trol DEVICES, INC.
142x N. KEATING AVENUE • CHICAGO 51, ILL.

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on HYDRAULIC CYLINDERS - VALVES - PUMPS - PARTS, etc. . .

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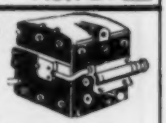

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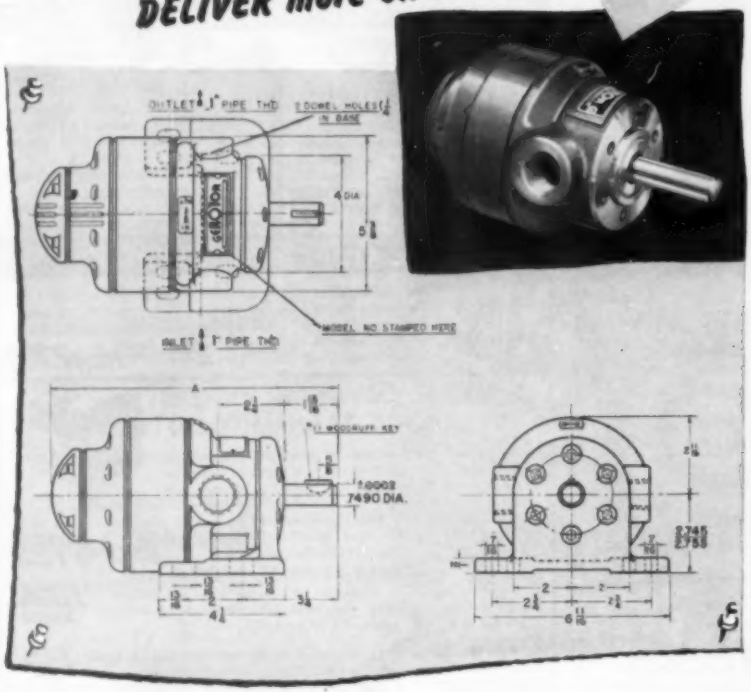

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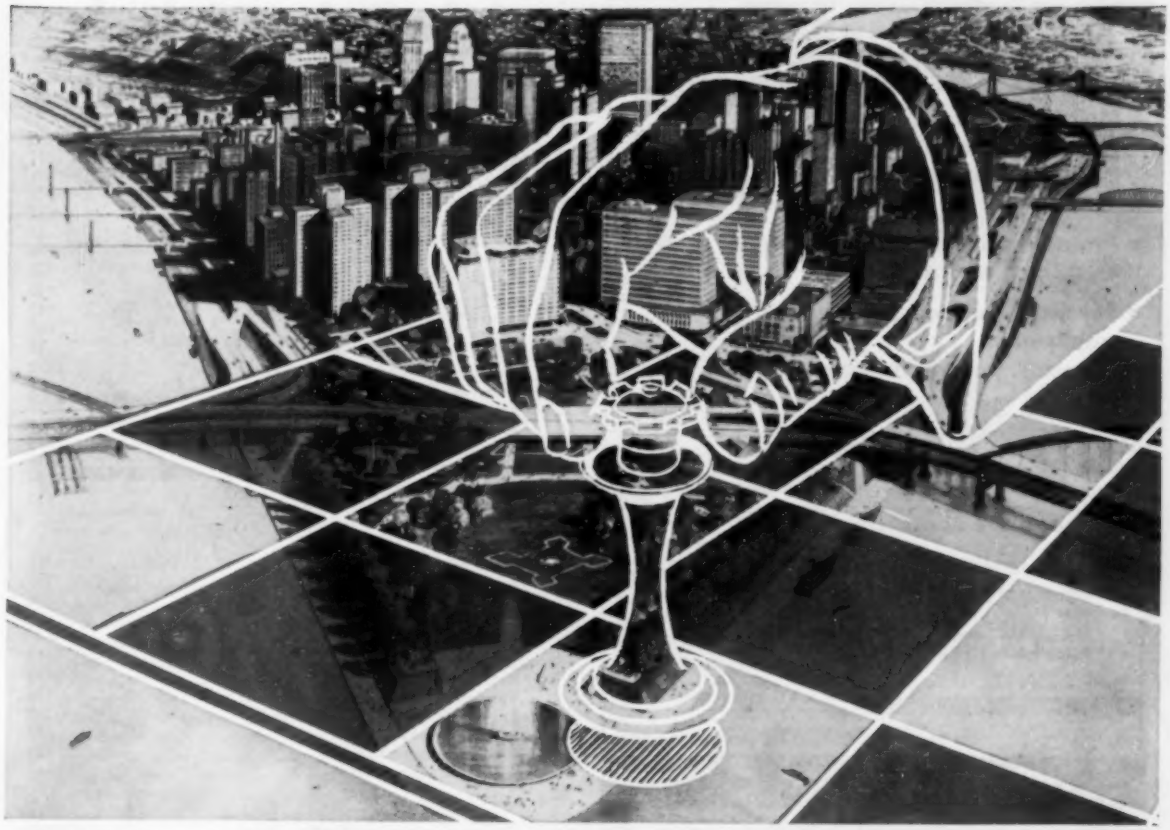

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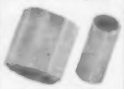

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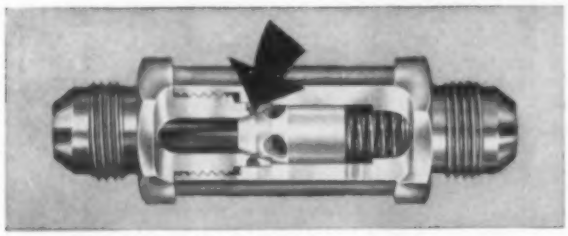

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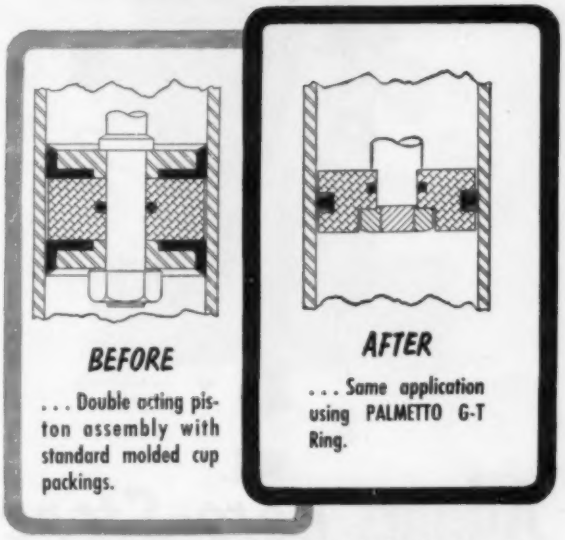
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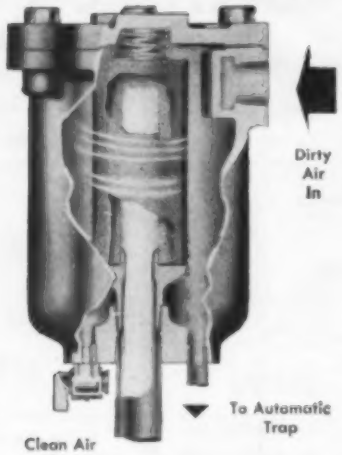

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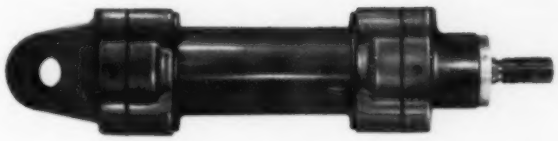

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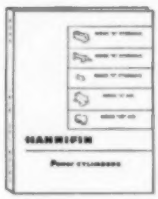

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